THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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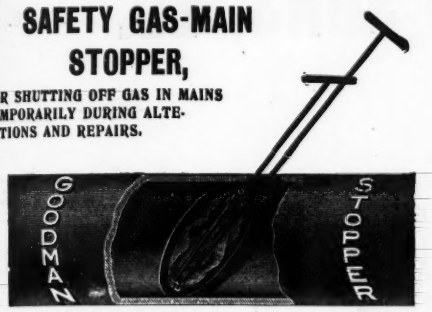

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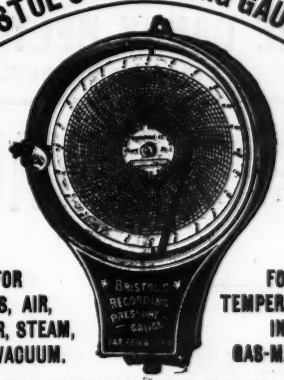

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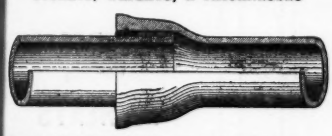

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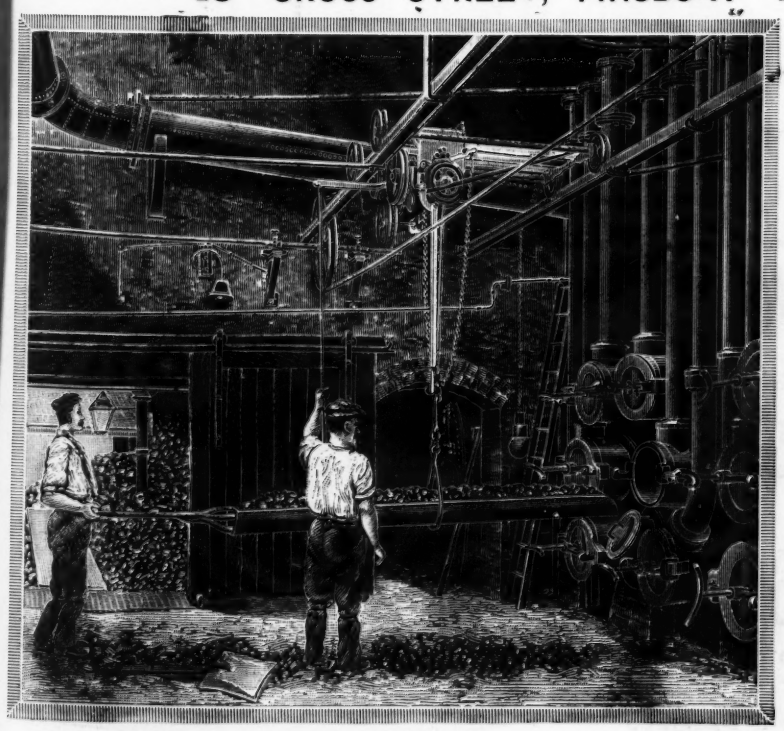

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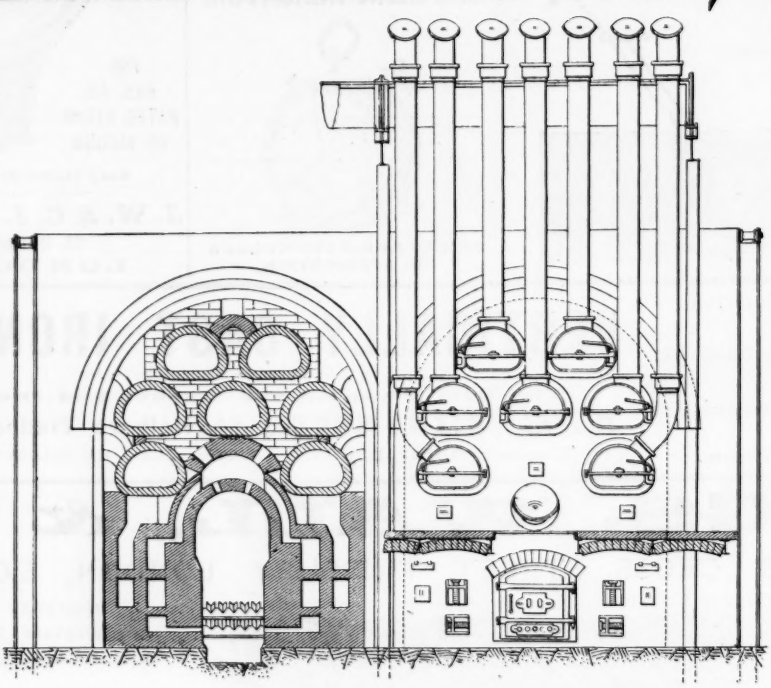

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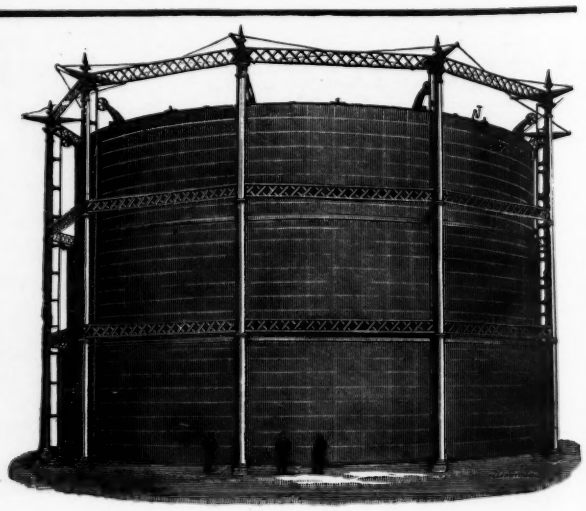

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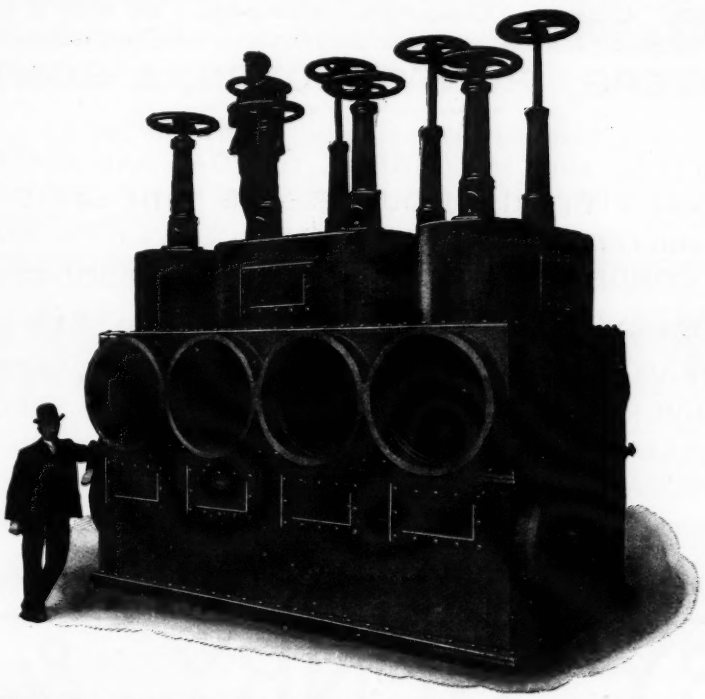

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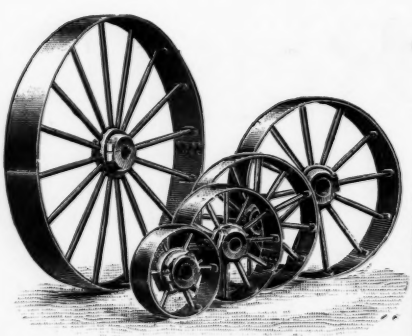

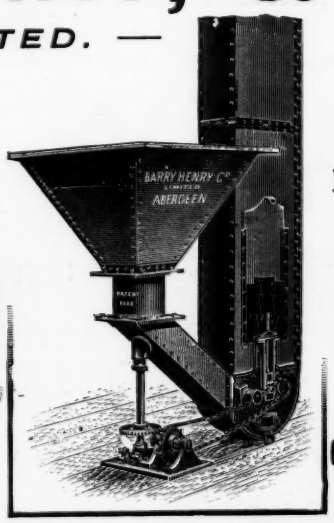

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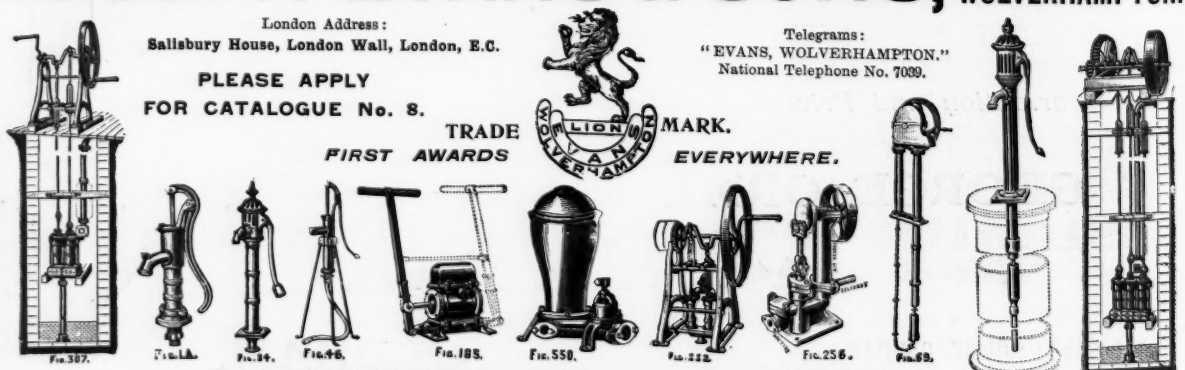

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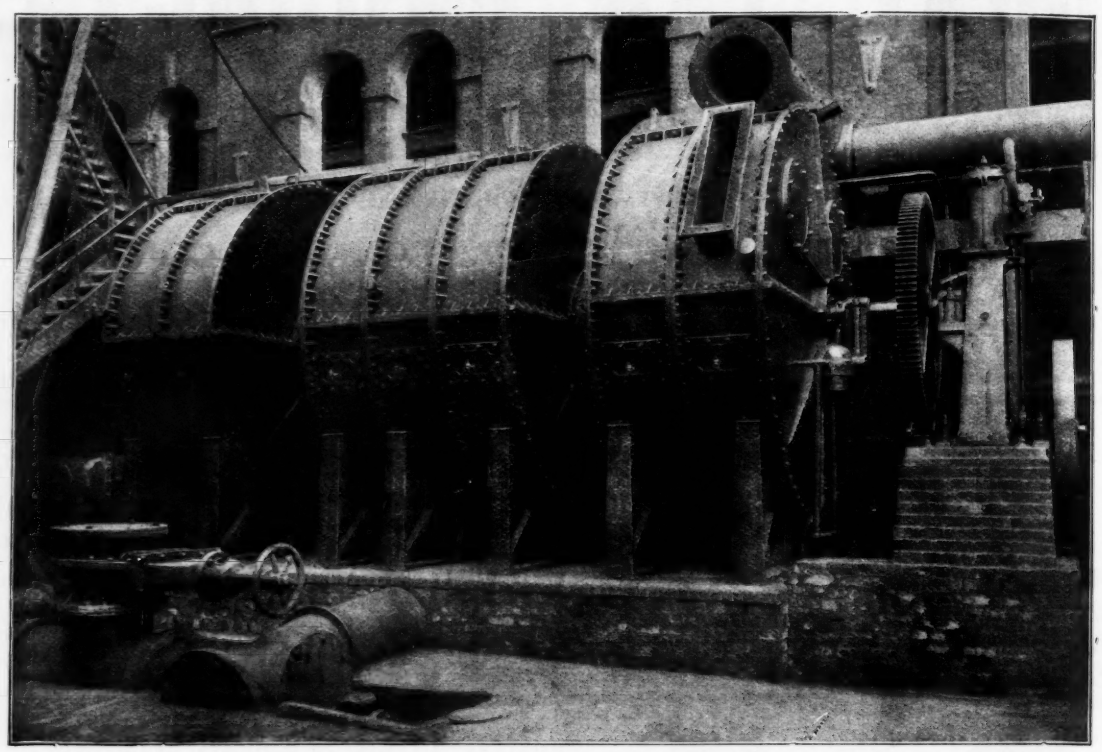

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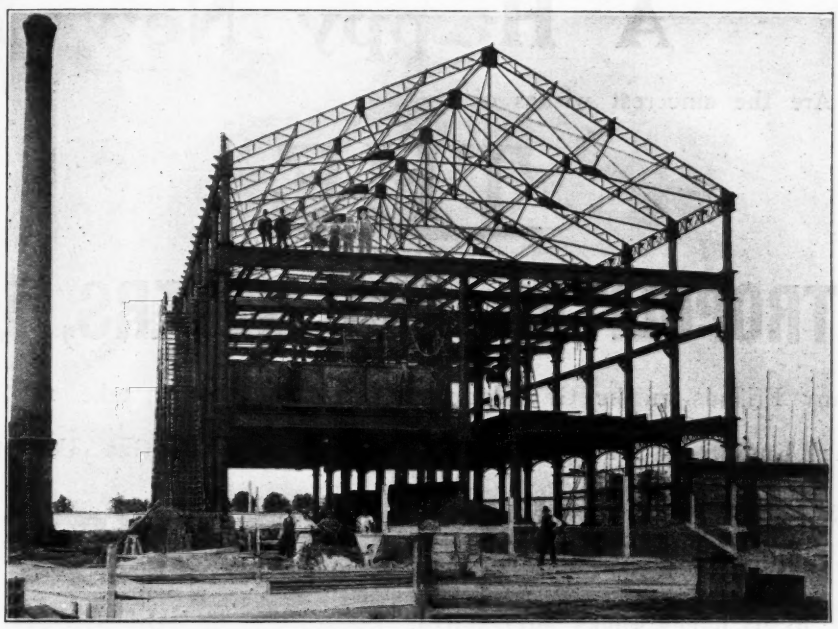

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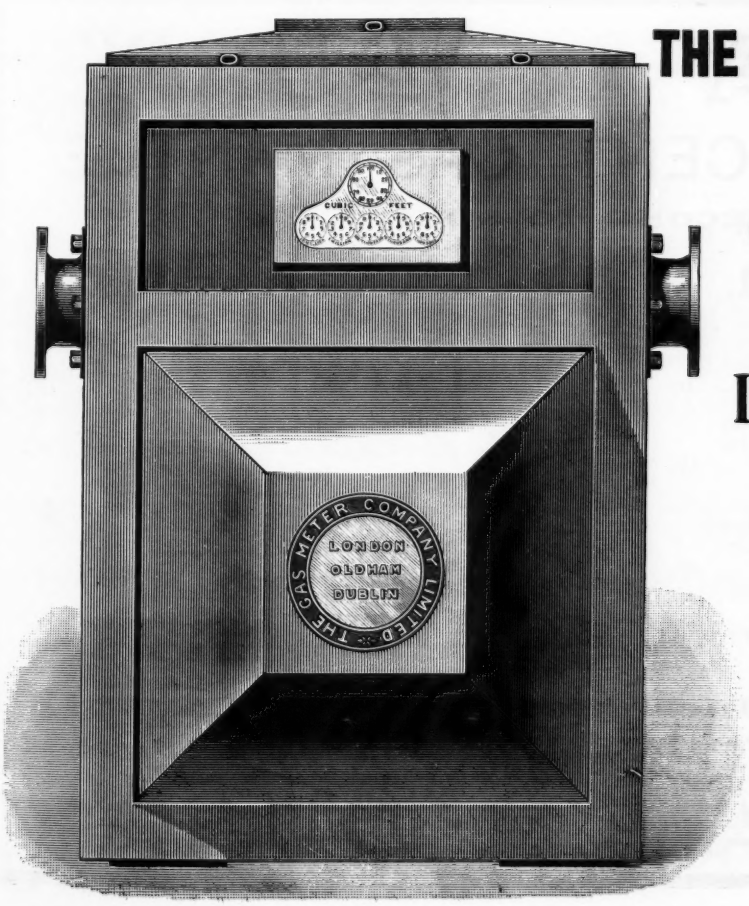

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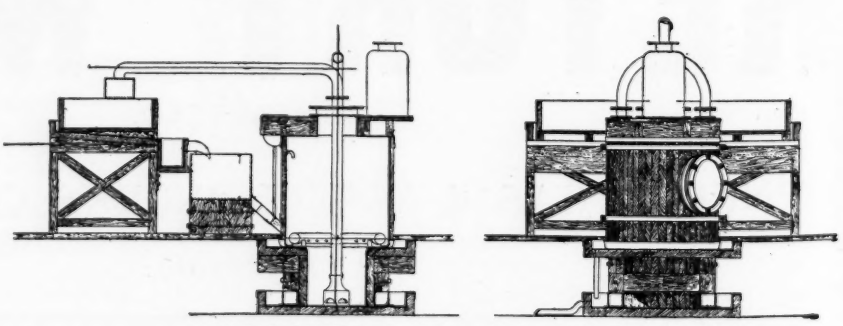

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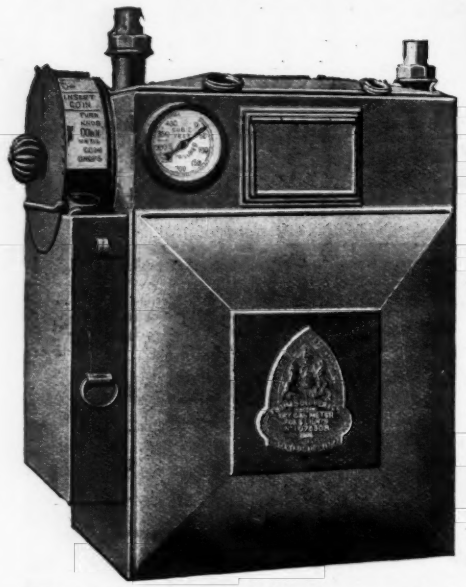

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EDITORIAL NOTES.

The Ruin of the Crystal Palace Gas Exhibition.

TO-DAY is the one arranged for the opening of the Crystal Palace Gas Exhibition; and what will be seen there will be merely the exhibits of the few firms who had fixed up their spaces before the disastrous breaking of the pledge given by the Council of the Institution of Gas Engineers to the Crystal Palace Company. Those who were responsible for this breach of faith can hardly rejoice over the meagre representation of the gas industry at the Palace during the next few weeks, nor can they be particularly proud of the result of their work. The act of the Committee completely alienated those manufacturers who had not committed themselves to exhibit; and, strive as much as he could, the Company's Organizing Commissioner was unable to gain further exhibitors in face of the withdrawal of the support of the Institution. On that withdrawal, the manufacturers—all except those who had settled the matter with the Company—dropped further consideration of the question of exhibiting, and there were (it is within our knowledge) many such. We are sorry for the Crystal Palace Company (who were so strongly urged to gain, and impressed with the necessity of gaining, the co-operation of the Council of the Institution) and for the exhibitors who took space on the faith of the Institution's support. All told, they do not number more than nine. They are Moffat's, Limited, with the Lucas incandescent gas-lamp; the New Inverted Incandescent Gas-Lamp Company, Limited; the James Keith and Blackman Company, Limited, with high-pressure gas lighting, ventilating machinery, &c.; the Plaissetty Mantle Syndicate, Limited; the Davis Gas-Stove Company; the Flavel Range and Imperial Gas-Stoves, Limited; G. W. Cuddon, with gas-stoves; George Wilson (of the Hague), with gas-meters, &c.; and Richard d'Henreuse (of Berlin), with incandescent mantles. That is a small show; but we hope the disappointment of the exhibitors will be compensated by a substantial benefit from their appearance at the Palace. They ought assuredly to get some reward, if only for what must be to a certain few gentlemen the extraordinary feat of having succeeded in getting their exhibits to Sydenham by Dec. 15. Though the stands are few, each firm appears to be doing its best to make the exhibits something worth seeing. After the wreck that their Committee have brought about this year (without any consideration for the labour and expense incurred by the Crystal Palace people), the Institution are in honour bound to do their utmost to promote the exhibition next year suggested in the Committee's letter to the Organizing Commissioner.

The Result of the Appeal as to the Law of Sunday Gas Testing in London.

IN last week's issue, we reported the beginning of the appeal case of the South Metropolitan Gas Company against the judgment of Mr. Justice Joyce, given in May, sanctioning the Sunday testing of gas in the Metropolis. The appeal was unsuccessful, so that the given decision stands; and the London Gas Companies have therefore to submit to this new-fangled interpretation of the obligation put upon them by the Act of 1880. There might, of course, be an appeal to the House of Lords; but inasmuch as the question at issue is really only the very small legal one of whether the word "daily" in the cited Act means every day, inclusive of Sunday, having regard to the nature of the matter, it is improbable that the action will be taken farther. We have reported the arguments of Counsel and the observations of their Lordships at length, on account of the instructive character of the points taken and dealt with, though the operation of the law does not extend beyond the Metropolis. It appears to the lay mind that the Company's strong point, and their only one, lay in the matter of "use "and wont." Expressed in the formula, the "custom of the "trade," this is a familiar pleading in every Court, from the highest to the lowest. A great Lord Chancellor is remembered, among other reasons, for saying that, in the main, there is no law but custom. Uninterrupted enjoyment is the best of all rights to possession. If it can be shown to the reasonable satisfaction of a judge or jury—the two are almost synonymous now—that a certain custom prevails, then, whatever the general law may be in regard to analogous practices, the custom is respected.

But, the very strength of this plea of custom requires a rigorous examination of facts. There is, moreover, another obstacle to the setting up of a custom, when there happens to be a contradiction to it in law, even where the law has been permitted to fall into disuse. In the present case, though it could be shown that it had not been customary to test London gas on Sundays from 1869, when the defendant Company was incorporated, until 1902, the Act under which the proceedings against the Company were taken was passed in 1880; and the Judges find themselves unable to say that the Legislature, in passing this Act, meant to conform to the practice of week-day testing only. In other words, the "custom of the trade" was not strong enough to annul the letter of the law. Four Judges, including Mr. Justice Joyce, are unanimously of this opinion. All our own observation of the ways of the Courts goes to support the general belief that Judges are very loth to hold that the plain letter of a statute has become dead through mere disuse. If a certain procedure is sanctioned by an Act of Parliament, it will take a very strong body of evidence to persuade the Courts that it is really obsolete. The simple fact of nobody having so far attempted to put it into action does not weigh heavily with the Judges.

One can readily sympathize with the South Metropolitan Gas Company, who have been foremost in the good work of reducing Sunday labour in the process of gas manufacture, in the position of technical offenders against the law, into which they have been forced by the London County Council. Several matters of detail will have to be rearranged in regard to this new fashion of the Sunday use of the testing-stations. The County Council have had to engage supernumerary Gas Examiners, because their regular staff did not engage for Sunday work. This way of getting out of a difficulty does not apply to the caretakers and other officers and servants of the Companies whose duty calls them to attend the Examiners. There cannot be relays of custodians, all responsible. It looks as if the London County Council are in the unenviable condition of those who lay upon others, and those men in a humble position, a burden of incessant service heavy and hard to bear, while they themselves do not touch it with the end of a finger. And possibly before the practice of Sunday testing gets regularized, certain remarkable developments may show themselves. For the present, it may be admitted that the law is on the side of the County Council. Much good may it do the gas consumers of London to know that their gas is tested on Sundays as other days of the week. Their Lordships of the Court of Appeal were apparently impressed by the consideration that gas is, as a matter of fact, supplied on Sundays, which struck them as good reason why it should be tested on that day. Certainly, gas is supplied on Sundays; and the same observation equally applies to the sale and distribution of other necessaries of life. But the inspection of weights and measures, as well as other official work of the kind, is suspended, harmlessly enough, on Sundays; and it is not a monstrous supposition that a matter of gas testing of which it has taken some thirty years to discover the desirability might have been left where it was. It is officiousness, not zeal in the public service, that invokes this rigour of the laws; and we have not the smallest hesitation in declaring that the Council in this matter have not done as they would like to be done by, were they in the Gas Companies' case.

The Weakness of Mixed Teams.

THE ancient law which forbade ploughing with a mixed team was just. Experiments designed to prove the feasibility of contrary arrangements are continually being made; but the result is always confirmatory of the immemorial rule. It may be admitted, in extenuation of some of these attempts

at the yoking together of incompatible forces, that their real natures, and therefore the fact of their incompatibility for going in double harness, are not always easily perceptible before the event. The difference between a horse and an ox is patent; not so the irreconcilability between the Benthamite and the Trade Unionist, or the Trade Unionist and the Socialist. As a consequence, we constantly witness endeavours to hitch two of these together, or all three, to the Car of Progress, with the invariable result of a "spill" sooner or later. Some recent upsets in the London County Council are referable to this cause. We allude for the moment to the burning question of the purchasing by the Council of steel tramrails of Belgian manufacture, as to which Mr. J. W. Benn, the famous popular entertainer who is now Chairman of the Tramways Committee, has found it beyond his power to answer plainly a plain question. The question is merely whether the Belgian workmen who make these cheap rails, work longer hours than English workmen in the same trade, for less wages, and likewise toil on Sundays. The official apologists for the County Council will not answer the question, for the simple reason that they dare not. Their silence is equivalent to an admission that they have run away, for the sake of buying in the cheapest market, from their own principles as indicated by the "fair wages" clause of the conditions of contract which they impose upon home tenderers for all supplies. What this means is, that profession of Trade Union sympathies is found incompatible with action on the Benthamite rule of accepting the lowest tender. The mixed character of the team is exposed, and it can no longer be hidden. Of two things, one. The London County Council, and all other public authorities who have followed their example of insisting upon the insertion of "fair wages" clauses in their contracts for supplies—conditions, be it remembered, which have sometimes been strained so far as to exclude from tendering all firms which are not classified, in Trade Union slang, as "fair houses"—must either be prepared to pay more accordingly; or they must, if they cling to the right of buying in the cheapest foreign market, drop the hypocrisy of pretending to Trade Union principles. The London County Council wish to sit on both stools at once; and the British workman will see that those members of any elective bodies who are personally identified with this attitude get their deserts.

Hitherto, both public and private purchasers have generally bought as cheaply as they could, as a matter of course. If a gas or a water company had an offer of a job lot of foreign pipes at a sufficiently tempting price, and the stuff was otherwise suitable, they had no sense of acting at all unfairly in striking the bargain. That is to say, that middlemen who had saleable stuff to offer could always find a purchaser. Yet it should be remembered, in this connection, that many large buyers never would deal with middlemen. Long before the idea of the "fair "wages" condition of public contracts had dawned upon members of bodies having the disposal of such contracts, it was the rule of the best buyers to pay what they considered to be a fair price for their supplies, and always to deal at first hand. Which was better for the trade of the country—such a rule as this, or an advertised "fair "wages" clause, with reservation in favour of the foreigner? The illogical character of much municipal buying, which sometimes proceeds upon the cast-iron rule of accepting the lowest tender, and on other occasions admits qualifying considerations not wholly unconnected with electioneering objects, appears in such purchases as those of gas-meters for a corporation department. Where Benthamism prevails, a local maker paying large sums in wages, and also contributing pretty heavily towards the rates, need expect absolutely no consideration whatever from the corporation gas department, if his tender happens to be 3 per cent. higher than that of a foreigner. He may be compelled to close a factory for want of a share of the local work; but this does not matter to the Benthamite. Yet his inability to quote as low as the foreigner may be due to the fact that the corporation requires him to subscribe to conditions which they are powerless to enforce upon his rivals. Or where there are no such special conditions, it is nevertheless the fact that the home manufacturer may be hopelessly handicapped by the higher standard of pay and living in this country, as compared with the country of origin of the foreign goods. It is rather hard upon the home manufacturer to be abused from one quarter for grinding the faces of the poor workpeople, while every advantage he confers upon them that is translatable into additional working expenses, stands in the way of his getting orders from public authorities who pose as "model employers" themselves, heedless of the cost.

No; Benthamism and Trade Unionism do not run well in double harness; nor is the "cock" horse, Socialism, which is so often hitched on in front of the team, a proper match for either. It is notorious that Socialism, in neither Great Britain nor the United States, made much headway as a force in politics until some Socialists, weary of crying in the wilderness, had the happy thought of jumping the claim of the Trade Unionists, with whom they had really no more in common than they had with the Teetotalers. This bold stroke, however, at once gave them a numerous following; and they lost no time in making their influence felt in the labour world, much to the disgust of the old Trade Unionists pure and simple, like Mr. Knight. The result was irredeemably bad for the Trade Unions; all the devastating strikes that failed, and all the judicial decisions that shattered the whole edifice, being attributable to the new style of Unionism. The structure that such men as Knight and Maudsley had worked upon for so many years —ever since, indeed, the overthrow of Broadhead made it possible for a respectable citizen to be a "society" man—was shaken to its base in the few years of the New Unionism which followed upon the Socialist irruption. Naturally, the Socialists failed to perceive the reason for this. The truth, however, could not be hidden for ever. The disclosure has actually occurred in the United States, where at the recent Labour Convention, called by the American Federation of Labour, the trade organizations declared their independence of Socialism, and declined to be identified with it. It is recognized that the aims and methods of Socialism are not those of any trade society, which has only the interests of its members to serve, and is not concerned with the reconstitution of society on the basis of the abolition of private property. On the contrary, the object of organization is to increase indefinitely the private property of the members. Incidentally, in the pursuit of their aims, the Socialists stick at no illegality; conspire to bring the law of the land and its agents into contempt; and condone any form of violence deemed necessary for the attainment of their objects. With all this the American Trade Unionists have just declared their disagreement; the Convention voting by 11,282 to 2185 in favour of the resolutions repudiating Socialism as the panacea for all the ills of the present industrial system. The conclusion is noteworthy.

The Leading Case of Marylebone.

THE leading case of *The Metropolitan Electric Supply Company v. Borough of Marylebone* has been noticed again this week in other parts of the "JOURNAL;" but its latest development may be mentioned here for the sake of its bearing upon the legal relations of a local authority to the proprietors of an undertaking which is in course of being transferred under an arbitration. This particular stage of the proceedings was an application by the Borough Council to Mr. Justice Buckley, in the Chancery Division, for an extension of the time for the payment of the purchase-money, which they had been ordered by his Lordship on July 2 to pay on the 31st inst. As all the world now knows, this unhappy Local Authority have found themselves unable to obtain a loan of the capital sum required to satisfy the order of the Court, and have committed themselves to the promotion of a Bill in Parliament for the necessary powers. Meanwhile, it is extremely doubtful whether the ratepayers will give their sanction to the Bill. The plaintiff Company are therefore in the position of having the whip-hand of the Council, which position they are rightly careful not to jeopardize by any remissness of action or sufferance. Accordingly, they put in an appearance on this proceeding, not so much to place difficulties in the way of the Council as to preserve their strict legal rights. The Company, that is to say, are prepared to do their part in the affair, and they expect the Council to perform theirs. It is no business of the Company how the Council raise the purchase-money in question. Unless the cash is forthcoming, the Company, of course, have their remedy, which is to compel the Council to levy a rate sufficient to discharge their claim—a trifle of £1,212,000, with costs. It would require a rate of 20s. in the pound to do this. Mr. Justice Buckley, when extending the time for payment to Feb. 29,

to enable the poll to be taken on the Money Bill, did not mince his language as regards the foolishness of the Council in placing the ratepayers in this position. He declared that if it came to the levying of a rate to pay the whole of the amount, "it would be a complete satire on municipal "trading." Clearly, the Judge did not think for a moment that the Bill of the Council would go through. If it did not, the situation would become more acute. This extension of time has to be paid for. Strictly speaking, the undertaking in the district is no longer the property of the Company, who are administering it pending transfer; and they have to keep on spending capital upon it out of their own resources. The Court has therefore ordered that £60,000 in respect of this capital expenditure shall be repaid to the Company within a short time; and the levying of a rate of 9d. in the pound to provide this amount is made a term of the order for postponement. There were also some further conditions as to interest and other matters; and the Council had to pay the costs. Altogether, it was a smart foretaste of what the ratepayers have to expect in the circumstances in which their scatter-brained representatives have placed them. The record will prove a useful caution to Progressives, that municipalities are no more superior to the law than companies.

The Yorkshire Junior Gas Association.

From a report in another column, it will be seen that the expectations of the founders of the new Yorkshire Junior Gas Association have been fully justified; for at the meeting held at the Bradford Technical College on Saturday the attendance was considerably larger than at the inaugural meeting six weeks ago, and this in spite of the dense fog which prevailed throughout the West Riding (causing considerable inconvenience to members travelling by rail to the meeting), to say nothing of the absence of any additional "attraction"—if any were necessary, so enthusiastic were the proceedings—in the shape of gastronomic arrangements at the conclusion of the business. This is an excellent sign, and augurs well for the prosperity of the Yorkshire Junior Association. The paper that was read by Mr. J. F. Smith, of Halifax (which, by the way, occupied nearly an hour-and-a-half in delivery), was perhaps too formidable a task for the Juniors to discuss and criticize at such very short notice; and so the members were wise to defer the discussion until the next meeting of the Association, by which time the Council will have arranged for a reprint to be in the hands of members. Mr. Smith's paper had, undoubtedly, been prepared with a view to inviting discussion; and evidently the writer of the paper purposely left "loopholes" for the members to tackle him on several points. But the lateness of the hour at which the paper terminated would have prevented anything like an interesting discussion. An excellent idea adopted by the Council of the Association is that of having their proceedings reprinted in pamphlet form and distributed to the members. At the inaugural meeting, it was felt that the brilliant lecture of Professor Smithells was well worthy of being kept in some permanent form; hence the reprints. And now the Council have gone one better by deciding to publish in a similar way their subsequent meetings, so that the reports of each session will form a valuable record of their transactions. The Yorkshire Juniors have started strong; and the healthy interest taken in the proceedings promises well for their success.

An Accident during the Dinner Hour.

Employers of labour will do well to pay attention to a recent judgment of the Court of Appeal which seems to largely extend the sphere of operation of the Workmen's Compensation Act. It is some time since any general interest attached to a decision under the Act; but this, which was only given last Friday, is of a very striking character. The case was that of *Blovelt v. Sawyer*, and was an appeal by the workman from the refusal of the Judge of the North Shields County Court to award him compensation for having been injured by the falling upon him, during the dinner hour, of part of a newly-built wall, he being a bricklayer who had worked upon the wall. The facts were not in dispute; but it was objected to the claim that the man was not at the time doing anything arising out of, or in the course of, his employment, and was for his own purposes in the place where he suffered the injury. It was open to the man to stay on the premises during his dinner hour or go away. However, on this particular day, the weather was wet and stormy; so he and some of his mates decided to stay, and sat down to eat their dinner under the lee of the wall which was in process of building. Here and then he met with his accident. It was admitted that the man was entitled to his dinner hour, as part of the conditions of the employment; but the County Court Judge seems to have held that he was not legally in the employment during this period, as it was not paid for. On the other hand, there are several cases of men having been granted compensation for injuries met with while on their way to and from their work, which was thus held to be an essential feature of the employment. It is clearly difficult to draw the line in a matter of this kind, or else a man might claim compensation for breaking his leg when getting out of bed to go about his daily duty. The Courts, however, exist to solve conundrums of this kind. In the present case, the Court allowed the appeal, on the ground that the man was in the employ of his master during the whole of the day; and the mere fact of his not being actually engaged on his main work, but eating his dinner, at the time of the accident, was not sufficient to enable it to be maintained as a matter of law that the accident, which certainly "arose out of" the employment, did not happen in the course of it. The Court was unanimous on the point. The judgment decidedly bears out the general opinion that the Courts are disposed to give the benefits of the Act the widest possible application of which they are capable.

Possible Protraction of the Monazite Settlement.

It will indeed be a happy relief when the monazite sand concession is settled. That once neglected and now highly valuable foreshore deposit of Brazil has been the cause of much internal and external contention and dissension; and every few weeks seems to bring an additional trouble. Last week we gladly announced the prospect of a speedy termination of the present state of uncertainty by the conclusion of a contract; but it was necessary to add the qualification that it, of course, depended upon the litigation between the States and the Federal Government not standing in the way. In the past week came news which indicates a further possible serious interruption. A notice published in the Brazilian Official Gazette early last month announces that the Government propose to authorize a geological survey of the deposits of these sands, with a view to ascertaining their extent and value, in order to determine the conditions on which such deposits shall be leased. This decision, in the view of His Majesty's Minister in Brazil doubtless implies the rejection of the tenders already presented, and the postponement of the settlement of the question to a remote date. This is an opinion of some gravity. The geological survey will no doubt be valuable. But the 1600 tons of monazite sand which were permitted to be exported a few months since will not meet requirements for an indefinite time; and if the fear of the Minister in Brazil turns out correct, months will probably pass before the survey is completed, new conditions framed for a contract, fresh tenders invited and a period allowed for their lodgment, and a tender finally accepted. In such an event, the authorities will again have to be approached for further temporary relief. In the meantime those who deal in thorium in Germany will continue to rejoice over the increasing profits which their control of the sands so far shipped from Brazil has given them.

Incandescent Burners for Slot Consumers.

Hearty welcome is given to the letter which has been contributed to our "Correspondence" columns by Dr. Jamieson B. Hurry, not only on account of the importance of the subject-matter of the communication, but because he is the type of man interested in gas affairs whom we should like to see more frequently figuring in the discussion of administrative questions as distinct from those of purely engineering concern, which, of course, require special training. Dr. Hurry is a Director of the Reading Gas Company; and he takes such an interest in his work as a Director that he has given close consideration to the paper contributed to the proceedings at the recent meeting of the Manchester District Institution of Gas Engineers, by Mr. A. E. Mottram, on "Why Corporations and Companies should undertake Internal Fitting Work." Dr. Hurry's letter is the result. On nearly every Gas Board, there will be found Directors whose

propensity is to rigidly confine their attention to the £ s. d. side of the administration, with the effect that they generally look with an austere eye on the laudable endeavours of their officials to promote new business which calls for an expenditure of money. Our correspondent, it is obvious, takes a wider view of his duties as a Gas Director, and concerns himself in the channels of current information on topics appertaining to management. Not only for the advantage of those channels, but in the interests of the gas undertakings which Directors and Committeemen assist in controlling, we would wish that there were more of them such as our correspondent. He writes to further advocate the supply of incandescent burners for slot consumers, and he does so for, among other reasons, the sanitary improvement it would introduce into the cottage homes of the working classes, where (as he puts it) the cubic space per inmate is limited. In his view, the difficulties opposed to the placing of incandescent mantles in the houses of the slot consumers are surmountable; and indeed Mr. Mottram and a few other gas managers have proved that the difficulties are nothing but phantasms. "A well-devised system of frequent inspection and maintenance of incandescent burners by special employees will go far to obviate difficulties. Such a system may be made both profitable to the company and advantageous to the consumer; while at the same time it will promote a friendly connection between the two parties." Those are words of wisdom extracted from Dr. Hurry's letter, which will be found well worthy of the consideration of all responsible for the management of gas undertakings.

A Joke or Malignancy?

Someone has been making a stupid joke or displaying extreme malignancy anent the installation of the Scott-Snell gas-lamps in Whitehall, of which mention was made in the "JOURNAL" last week. It has got into the papers that the standards will be fitted with electric lighting apparatus, so that if at any time the gas-lamps fail, there will be an alternative. This is really amusing, whether fun or ill-favour set the story afoot. We have frequently heard of gas-lamps being kept as a stand-by to the electric light, and to good purpose; but never has it come to our knowledge that gas-lamps have been furnished with electric lighting fittings to perform the same useful function that gas has often undertaken for its failing rival. In fact, it is only in the case of an extreme accident that gas has ever been known to fail; and we are afraid that electrical fittings would perish long before they would be required, if their use depended on such an event. Notwithstanding the foolishness of the statement, the Scott-Snell Company have felt it incumbent upon them to contradict it, in order that the ignorant may not be misled. The ignorant apparently include a few newspaper editors. We hope that there is a little more truth in the report that the lamp-columns which have been removed to make way for the new Scott-Snell lamp standards were erected eighty years ago, and bear the monogram of George IV.

The Latest Development of Municipal Trading.

The recommendation of the Watford Electric Light Committee, that the Council should enter into negotiations with the North Metropolitan Electric Supply Company for the sale of their works, has (as noticed elsewhere) since been followed by an even more significant move in the same direction by the Willesden District Council. As was stated in last week's "JOURNAL," the Committee's proposal found favour at Watford, and now the authorities at Willesden have gone a step further, and have resolved to sell their electric light works to the same Company. The motive which has actuated the two Councils is precisely the same—namely, the conviction, borne in upon them by experience, that there is but little hope of the concerns being made remunerative under existing conditions. In other words, they have failed to realize the "certain benefits" which are said to accrue to the possession of these monopolies; while additional large capital expenditure is needed in both cases. Under these circumstances, they have adopted a course which must commend itself to those who look at the matter from a business point of view. This reservation is necessary, because, of course, the extreme section of municipal trading partizans do not allow their opinions to be influenced by anything so vulgar as mere commercial principles. It may yet be too early to congratulate Watford on having done with electrical speculation; for the decision so far arrived at only binds them to make inquiry of the Company as to what they are prepared to offer for the undertaking. It is, however, different, as regards the Willesden Council; they having determined to sell.

A Shunt at Willesden.

Naturally, such an important development has not been passed over in silence by the general newspaper Press. In an article bearing the above title, the "Pall Mall Gazette" remarks that Willesden has performed an act of simple, though undoubted, heroism, in determining to profit by the lessons of experience before the fees become too high, by selling their works to a Company who run the business neither for amusement nor for philanthropy. It is pointed out that no blame is to be attached to the Council for their financial failure, inasmuch as district councillors have not as a rule been apprenticed to electrical engineering. It may be noted, however, that at least one of the members of the Watford District Council does not think any such training is necessary to success; for, as stated in last week's "JOURNAL," he objected to the proposal to sell because it would be an admission that a body composed principally of the tradesmen of Watford were unequal to properly conduct an undertaking of this character. Our contemporary is so delightfully outspoken in its opinions, that we cannot refrain from quoting the following few sentences from the article referred to: "There are few pleasures greater than that of spending other people's money. At any rate, there seems good reason for such a conjecture, although it is a point on which only a limited number of persons can speak from experience. Judging, however, from the conduct of those who pass the moneys of the public through their hands in urban district councils and other seats of majesty, there seems evidence that the delight of drawing a long cheque is not diminished when the account is not your own, but that of the admiring fellow-citizens who have been moved by your many virtues and talents to promote you to commensurate office and dignity. To refrain from adding to public expenditure when the opportunity is offered of putting a little more on to the rates, is an act of self-denial on the part of municipal nature which should not pass unnoticed."

The Other Side.

It is not surprising to find that what has happened has proved almost a knock-down blow for our friend the "Daily News," which has taken a prominent part in the discussion of questions of this nature. Monopoly, it says, is again winning over the municipality to act against the people's interests; and this time it is the British Electric Traction Company—an "octopus," one of whose tentacles is the North Metropolitan Electric Supply Company. That the seriousness to the municipal trading cause of the situation thus created is well understood by our contemporary, is made manifest in every line of the article, which appeared on the morning of the day appointed for the consideration of the proposed sale by the Willesden Council. All through, there runs condemnation of the ways of the British Electric Traction Company and of the attitude of those councillors who are anxious to save the ratepayers' money. This is all very well; but it should be borne in mind that the unfortunate Councils, if they wish to dispose of their works, must find a purchaser where they can. It is not everyone who is anxious to take off their hands electric light undertakings which "have not been as successful as was anticipated." The Company who have expressed willingness to do so may not be actuated by any other motive than that of benefiting themselves; but this, of course, is no reason why the bargain should not be a good one for both sides. The article contains one statement referring to the action of the Willesden Electricity Committee, in recommending the sale of the generating station and the purchase in future of electrical energy in bulk from the Company, which it is difficult to understand. It is this: "How the Committee has been converted to this extraordinary view of its duty to the public, only the members themselves—and the Company—can say." Rather than place what would seem to be the most natural interpretation upon this, we prefer to think that it has no meaning at all.

Prepayment Meter Law.

The Chairman of a very large Company whose prosperity depends, at any rate to a great extent, upon success in maintaining their patents, when addressing a meeting of the shareholders

a few days ago, is reported to have said that the only Court into which they had not had to take their patent actions was the Divorce Court. While the same thing cannot, of course, be said of the prepayment meter, the attention of Magistrates and County Court Judges is nevertheless frequently drawn to it. A case of which gas suppliers generally may take note was heard at Dolgelley recently (and is reported in our "Legal Intelligence" in this issue); the Barmouth Gas Company, Limited, having sued one of their customers for the difference between the sum found in a prepayment meter and the amount which the index showed to be due. It is true that the point raised was not altogether a new one; a case growing out of somewhat similar circumstances having been decided against the Kendal Gas and Water Company as long ago as 1894, as reported in the "JOURNAL" for May 22 of that year. In view, however, of the attention that has of late been given to the question of prepayment meter agreements, special interest attaches to the matter at the present time. In the Barmouth case, there was no agreement; and the defendant stated that nothing had been said to him as to the use of the meter. He therefore seems to have thought he was entitled to all the gas he could get for a penny. Not even the fact that he obtained about five weeks' supply in return for one penny (which got stuck in the meter) was able to shake this simple belief!

The Absence of a Clear Understanding.

The Judge held that, as the Barmouth Gas Company had not made it clear that consumers were only intended to have 16 cubic feet for a penny, people might reasonably think they were entitled to as much gas as they could obtain for this sum; and he therefore found for the defendant. Counsel for the Company did his best, until at last the Judge was moved to remark: "It is a fine sight, no doubt, to see a strong man struggling with adversity." This, though no doubt highly complimentary to the advocate, was not so as regarded his case. The difficulty which faced Counsel can, however, be overcome; and we imagine that in future the gas consumers at Barmouth will find themselves prevented from taking advantage in this way of mechanical defects in their prepayment meters. The Company may be expected to benefit to this extent at any rate from the experience they have bought. But it will be seen from our report that even on this occasion the Company were not wholly defeated; the defendant losing on a counterclaim for damages for the cutting off of the supply of gas to other premises belonging to him. The Company is a non-statutory one; and he based his claim on the fact that "no written notice as required by statute was given" that the supply would be discontinued.

Benzol Enrichment.

It is true that two years ago a leaderette appeared in these columns announcing that the Leeds City Council had appointed a Committee to inquire as to the permanency of benzol enrichment; and the suggestion was then made that the Council would confer a favour on the gas industry by extending their inquiry and publishing the result. We, like "Gas Examiner" (from whom a letter appears elsewhere), have been watching for the result of the inquiry; but in vain. Something has happened, if the inquiry was held, to keep the results from the gaze and criticism of the outer world; and this is to be regretted. Perhaps Alderman Lowden or Mr. Townsley will explain. "Gas Examiner" may not know that there is less reason now than before for benzol enrichment at Leeds, seeing that the Corporation have a carburetted water-gas plant, equal to the production of not far short of 2 million cubic feet per day; and therefore their interest in the matter about which he writes must have been considerably lessened. Moreover, their interest in enrichment of any kind will be reduced by the difference between 16 and 18 candle gas, if they get the sanction of Parliament (as they are almost certain to do) to the supply of gas of the lower illuminating power. At the same time, we fully endorse the appeal made by "Gas Examiner" for experiences in the matter of benzol enrichment.

At the last meeting of the Royal Institution, a resolution was passed recording the deep sense of the loss sustained by the Institution in the decease of Sir Frederick Bramwell, Bart., D.C.L., LL.D., F.R.S., M.Inst.C.E. His personality and the signal services he rendered to the Institution were alluded to.

WATER AFFAIRS.

The Metropolitan Water-Works Arbitration.

WE left the proceedings in the water arbitration last week at the point where the case of the New River Company had been brought to a close, on the twenty-fourth day of the inquiry, and that of the Grand Junction Company opened by Mr. Balfour Browne, K.C. The Company claimed altogether £4,863,195 and their costs; the principal item in their statement being a sum of £4,260,000, the maximum dividend of £117,150 capitalized at 36·36 years' purchase. They also claimed £452,299 for prospective net profits to make up back-dividends, £26,715 as surplus profits to next June, and £55,540 paid in respect of the Staines reservoirs scheme. The learned Counsel pointed out that this case was much less complicated than the one just closed, and remarked that the questions the Court would have to consider were whether the income of the Company was maintainable, and the possibility of it being greatly increased. The first witness called was Mr. Walter Hunter, the Engineering Director of the Company, who stated that, though he did not look for very great growth in the population to be provided for, he anticipated a higher revenue, in consequence of the changes now in progress in the character of the property supplied. However, the Company had sufficient water and storage to last them till 1914, without having recourse to the works at Staines. The cross-examination of Mr. Hunter was directed mainly to the subject of the quality of the supply, which Mr. Fletcher Moulton, K.C., endeavoured to show was seriously affected by the inadequate storage capacity of the works. But the witness pointed out that, as the Company had a large filtering area, extensive storage was not required. Mr. Hunter was followed by Mr. Samuel Wood, who was questioned with reference to the accounts. He estimated at £122,669 the total maintainable income of the Company for the year 1902, compared with the £117,642 shown by the accounts; and he said that if the concern continued to progress as it was expected to do, all the back-dividends would have been paid off by 1928. Mr. Daniel Hill, a Chartered Accountant, agreed generally with Mr. Wood's figures. He had adjusted the accounts, and brought out the total maintainable income of the Company at £122,650.

The attention of the Arbitrators was next directed to the quality of the water supplied by the Company, which, as already mentioned, had been attacked by Mr. Moulton in his cross-examination of Mr. Hunter. Sir William Crookes was the first witness to be called upon this point; and he declared that the water as delivered to the consumers was perfectly potable, whether regarded from a chemical or a bacteriological standpoint. A good deal had been made by Mr. Moulton of the reports of Dr. Thorpe, the Chief of the Government Laboratory, to the Registrar-General, particularly with respect to the bad colour of the water; and the President appeared to be desirous of obtaining from the witness a definite expression of opinion as to the possibility of this discoloration being dangerous to health. Sir William raised a laugh by saying that on the day specially mentioned by Dr. Thorpe the colour resembled that of 35 gallons of perfectly clear water with a cupful of tea thrown into it. Professor Dewar followed on the same lines, and stated that the Company supplied a good potable water. As far as microbic impurity was concerned, the filtration had never been better than it was now; while the Registrar-General's returns showed that no injury to health had arisen from the discoloration of which complaint had been made—the Company's district being healthier than any other in the Metropolis. In regard to microbic impurity, when the Professor was confronted with an analysis showing 213 microbes in a cubic centimetre—about 15 drops—of water, he said that the sample was an abnormal one, due to the unsatisfactory position of a tap. Curiously enough, it had come from the house of his colleague, who explained the conditions under which it had been obtained, and added that, though the collector considered it would not be fair to put it in the books, he insisted upon its inclusion. However, Professor Dewar did not seem to think there was any great cause for alarm, for he stated that while raw Thames water this year contained 16,000 microbes per cubic centimetre, against an average of 5000, the filtered water was just as good—showing the efficiency of this portion, at all events, of the Company's plant, whatever might be said with regard to their

storage. The witness put in a statement of the number of samples of water, taken from the filter-wells, stand-pipes, and house services, which he and Sir William Crookes had examined bacteriologically by the Koch method during the present year; and they showed, on the whole, very satisfactory results. This testimony to the good quality of the Company's supply was followed by some evidence as to its adequacy; Mr. Charles Hawksley, Mr. Henry Rofe, and Mr. E. K. Burstal all agreeing that 33 gallons per head per day was an ample allowance, and that even 30 gallons would be enough.

With this evidence the Company's case closed, and Mr. Fletcher Moulton proceeded to open that of the Water Board, and call witnesses in support of it. This occupied the Court till Thursday. On Friday, Mr. Balfour Browne replied, and this brought the case to an end. The Court then adjourned till to day, when the President will pronounce a decision as to the applicability of the Chamberlain of London's sinking fund to the Staines reservoirs works, and then take up the case of the West Middlesex Company.

British Association of Water-Works Engineers.

THE members of the Association to a number rather larger than is usual at the winter meetings, got through a fair amount of useful work at Burlington House, last Saturday. The quantity of technical matter provided was, with the other business, more than enough for a single sitting, and yet not sufficient to have justified re-calling the members after a break for an afternoon sitting. It is, we know, in these matters, very difficult to strike the happy mean; but the result was that one of the papers received scant and barely courteous treatment. This was the one by Mr. Neil J. Peters on "The Cogan Extensions of the Cardiff Corporation "Water-Works." The two previous papers, however—the first by Professor Henry Robinson on "The Storage of "Flood Water," and the second by Mr. A. J. Jenkins on "The New Reservoir for the Hoylake and West Kirby "Water-Works"—raised some interesting points, which we shall be noticing in succeeding numbers.

Among the general business was an interesting report on the issue of the conference recently convened by the Worshipful Company of Plumbers, on the questions of the training and registration of plumbers, and the standardization of bye-laws, regulations, fittings, and workmanship. Although no one can be more qualified than water engineers to deal with these questions, there was just the danger, but for the timely intervention of Mr. Percy Griffith at the conference, of the Association not being specifically and officially identified with the future consideration of, and proceedings connected with, any proposals that may emanate from this movement of the Plumbers' Company. However, the Association are, through that action of their Secretary, to be represented by two members on the Joint Committee that has been formed; and Mr. P. H. Palmer, of Hastings, and Mr. Percy Griffith are the chosen two. It will be noticed that the Joint Committee are going to consider the questions of standardizing not only fittings, but bye-laws, regulations, and workmanship. Standardization of fittings and metal parts has always been recognized in these columns as something worth gaining, in so far as economy in time and expense and convenience is attained. But when it is proposed to go beyond that, and standardize bye-laws and regulations, it seems to us—unless the standardization is merely to be in the nature of a model to be adapted to local circumstances—that standardization is being pushed a bit too far. What, again, is meant by "standard workmanship?" It is not clear from the resolution whether the "workman-"ship" is intended to apply to the finish of the fittings or to the plumbers' work. If to the latter, it would be interesting to discuss the question. But it may be useless doing so without knowing just exactly what is meant; and that, we expect, will not be until the Committee have finished their labours.

The election of officers also engaged attention; and, as was fully expected, Mr. F. J. Bancroft, of Hull, has been called upon to succeed Mr. Swindlehurst in the presidential chair at the close of that gentleman's year of office. Mr. Bancroft has won the esteem of his professional friends in the organization by his unremitting activity in promoting the objects of the Association—by his work on the Council, constant attendance at meetings, and contributions to debate. It follows that the next annual meeting will be held at Hull, where the members may depend upon a cordial reception. The occasion is to be signalized by a departure from what has become to be customary at the annual meetings. The proceedings are to be followed by a trip to Antwerp, Brussels, and other places of interest on the Continent; and the programme, as at present projected, will occupy fully seven (and possibly ten or eleven) days. The Chairman of the Antwerp Water-Works Company (Mr. T. Easton Devonshire) has tendered the members a hearty invitation to see their works and to accept of the hospitality of the Company—in fact, the Continental journey throughout will be a mixture of professional interest and general sight-seeing and pleasure; but the pleasure will, according to the forecast, bulk largely. The project is an ambitious one for an Association that cannot get perhaps more than forty or fifty members together for an annual meeting in its own country; and it is to be hoped that, going abroad for the first time in a corporate capacity, the number who take part in the journey will not be reduced to an undignified point.

ESSAYS AND REVIEWS.

THE CONDITIONS OF GOOD LIGHTING.

THE systematic utilization of the available means of artificial lighting for various purposes, is a blend of science and art which has been more cultivated of late than was at one time either necessary or practicable. It is only since the world has been in possession of cheap means of producing serviceable artificial lights of any desired power, capable of being installed anywhere, that the study of the proper use of these lights to satisfy particular needs has been possible. Since the introduction of electric light, this study has been more patronized than it was before, in consequence of the lamentable blunders in the use of the light perpetrated by the early experimenters in this technic, who repeatedly betrayed their ignorance of the art of making proper use of their own speciality. To this ignorance the world owed such vagaries as the "tower" system of lighting towns (upon which large sums of money were wasted), and almost equally futile experiments with incandescent electric lamps. Of course, those who committed these errors did not deign to seek instruction from gas engineers and scientific writers, who knew all about the optical and physiological sides of lighting practice; but they and their successors in the electric lighting trade preferred to work round to the same point by their own unaided efforts. The result has been a batch of somewhat self-important books and papers on the subject, by a group of Americans chiefly, who appear to labour under the common delusion that obliviousness of earlier work in the same branch of knowledge constitutes originality. We recently had occasion to review the book of an amiable and well-meaning sciolist of this order, Dr. Louis Bell, who contrived to fill a volume with observations on the subject of lighting, without once referring to the labours of the French or English authorities. Now, again, our attention has been drawn to an article in "Feilden's Magazine," bearing the awkward title of "The Engineering of Illumination"—obviously emanating from an American source, since only American data are supplied.

This sort of impertinence is very annoying, especially when the superficiality of information upon the subject, which might be pardonable in an author of a paper to be read at a Western American Engineers' Society, is given currency in a so-called engineering magazine pretending to be English. This publication introduces the article with the assertion that "there is, perhaps, no equally important branch of engineering to-day on which (*sic*) as little study has been given as that of scientific illumination." This language is not even English; and the writer only confesses thereby, in his poor manner, his own ignorance of a branch of engineering study, "on" which, as he would say, the American writers who are alone mentioned by him, "Mr. W. D'A. Ryan, Dr. Louis Bell, Prof. Wm. L. Smith," have added nothing to what had been previously published by Dr. Palaz in France, Wybauw in Belgium, Uppenborn in Germany, and A. P. Trotter in England. Many others might be named; but the foregoing suffice to support our protest against the assumption that nobody knew anything worth knowing about lights or lighting before these Americans undertook to enlighten the universe on the subject. As a matter of fact, the economics, and the physics, and the physiology of artificial lighting are very well known indeed, and are adequately expressed in the writings of men who were not only masters of their subject, but were also able to write of it in good, intelligible language. Gas engineers are justified in feeling a little sore at the tacit assumption of these raw hands, that no street or interior was ever properly lighted before they undertook to lay down the law about it. The paper in "Feilden's Magazine" is a dreadful example of bad diction. What, for instance, is to be understood by

the following, which is intended to convey a lesson worth giving, in a way: "Any person who has worked for some time under a swinging incandescent lamp, covered by a porcelain or tin reflector, will have noted the fatigue of the eyes, due to the bright streaks on the paper, which are inherent in the incandescent lamp and intensified by the reflector. In fact, an office so lighted, unless it is superimposed on a good general illumination, is a fine example of something to be avoided, and will quickly ruin all but the strongest eyes." What is the averment made in the former sentence? Something is stated to be "inherent" in the incandescent lamp. What is it—fatigue of the eyes or bright streaks on the paper? These are the only things mentioned, and neither of them belongs to the lamp. Again, what is the predicate in the second sentence? If the writer meant to state that it is the swinging of the electric incandescent lamp which is objectionable, he should have said so. As a matter of fact, this is a great objection to the cheap incandescent electric light fitting so general nowadays. No one should attempt to work by an unsteady light of whatever nature.

The next requirement for good lighting, after steadiness of the light source, is the avoidance of what is commonly called "glare"—meaning the exposure to the eye of the naked light source itself. In this regard, both gas engineers and purveyors of electric light have been great sinners against the laws of physiology, while paying inordinate respect to the light intensity of sources. To many, perhaps to most, gas suppliers whose thoughts were weighed down by the factitious importance attached by photometrists to "illuminating power," it seemed an outrage to put the gas-flames so painfully brought up to the required legal standard of brilliancy, inside opal gas globes known to diminish the measured luminous intensity by one-third of that of the naked flame. The same reluctance was felt by electricians, who knew that the extravagant estimates of the candle-power of arc lamps in which they indulged, for the overawing of local authorities, would not bear examination through an opal glass globe. In both cases, the fact was overlooked that a source of light is only of use when it is not employed decoratively, as a means to an end—which is that of enabling objects to be seen by the eye. In respect of the use of gaslight, this consideration was adequately met by the proper use of diffusing glasses which were also reflectors of the light in directions where it was unlikely to meet the eye. The electric arc light does not lend itself to such treatment. The only kind of light-diffusing glasses which suit electric lamps at all well are those with facets, and of these the "Holophane" globes are universally agreed to be the best. The main drawback of all such light-diffusing glasses for powerful artificial lights is their liability to accumulate dust, which makes an outdoor lantern of this description an eyesore.

It is probably correct to state that the very latest practice in regard to street or outside lighting is in the direction of discarding light-diffusing glazing, whether by means of opal or facetted glass, and relying upon reflectors for securing very much the same effect in a better and cheaper way. At any rate, the observation is true of the most improved high-power incandescent gas-lights, which are superseding electric arc lamps wherever expense and efficiency are mainly regarded. The intense, painful, scintillating brilliancy of the minute source of the light of the electric arc renders it useless without thick diffusive glazing; but this is not the case with the steady, unobtrusive high-power gas-light. The practical effect of this difference of the way in which the light of the two unit sources is produced is that, whereas the eye is attracted to the twinkling electric light (with the consequence of being temporarily blinded), it is not so attracted to the steady gas-light, the very location of which can thus be ignored. Therefore, if nobody is tempted to glance at the gaslight—which is further assured by simply elevating it above the line of horizontal vision—there is less need for screening it. This consideration—of the vertical height to which lights should be elevated according to their power—is most important in practice, though it does not always receive due emphasis in theoretical writings.

One other highly important practical deduction from abundant experience is to be noted, which is, that there is a rational proportion between the dimensions of a space to be lighted and the power of the sources which will do the work most effectively. This consideration, it will be noticed, has nothing to do with the computation or measurement of the actual amount of light received on the ground, in such cases, expressed in candle-feet or any other suitable measure. The question of whether a given area, indoors or out, should be lighted by a number of small sources or by a few powerful ones is almost more a matter of art than of pure science. Those who can recollect the electric lighting of certain halls and corridors of the South Kensington Exhibitions by a multitude of incandescent electric lamps in the ceiling, will have no difficulty in appreciating the point. The multitudinous spiculæ of light in such examples dazzle and annoy, more than they assist the sight. To be at once useful and agreeable, therefore, the lights of large spaces must be massed, not scattered. Scattering is not the same as distribution. The difference, and how to give proper effect to the idea, are rather matters of taste than of knowledge—in other words, as we have remarked, this is more of an art than a science. Happily, there is no longer any question but that the quite feasible and economical limits of high-power gas lighting are competent to command any rational solution of such a problem; and it is not possible to aver truly that any other means of obtaining the requisite amount of light is to be preferred, for reasons pertinent to the service required to be rendered.

CRITICISM OF MR. A. G. GLASGOW'S "POLICY OF GAS ENRICHMENT" PAPER.

THE paper which Mr. A. G. Glasgow contributed to the recent meeting of the American Gaslight Association—however much it may have aroused attention, without retort, in the small circle of London gas engineers—appears to have fallen particularly flat in America. And small wonder, seeing that the policy of gas enrichment "illustrated by London practice" must be a matter of very remote concern to the gas men on the other side of the Atlantic; and so far as can be gathered they are still marvelling as to why Mr. Glasgow took a paper, full of controversial matter, so far from its centre of interest, where it could alone be discussed.* That is a point upon which we cannot hope to enlighten our American friends. However, at the time of the meeting of the American Association in October, Mr. John West happened to be in the United States; and, by invitation, he attended the meeting. Since his return, we have had an opportunity of having an interesting chat with him; and it seems that the overwhelming bulk of the paper, and the scant concern that the American gas engineers had in it, left Mr. West as the only speaker to offer serious criticism upon it. The circumstance that he was far from home without means of reference for attesting and supplementing his points, was not altogether encouraging; but he made, so far as was possible, a bold stand against a formidable dissertation which bears the indications of having been the work of considerable time and careful research. In this, the author of the paper had the advantage of his opponent. It is hoped by Mr. West that those who have adopted, with the consent of Parliament, the policy of dispensing with gas enrichment will not allow themselves to be the subjects of judgment by default in connection with Mr. Glasgow's paper. Finding himself in the position of being the only engineering representative of the British gas industry at the meeting, he says that, although he did not desire to discuss the question, he was of opinion that the statements were presented so unfairly that he was compelled to speak and criticize them. Therefore, he took up the cudgels in the defence of the straight coal-gas men whose policy was attacked out of their hearing; and he is quite prepared to continue to take a part in any discussion which the paper or his remarks may provoke, in order to get the points at issue fairly settled.

Mr. West has supplied us with the material from which the line of his argument at the meeting can be presented. Mr. Glasgow was absent (through illness) at the time; and this was a matter for regret on Mr. West's part, though he was glad to see Dr. A. C. Humphreys representing his friend. He told the meeting that he had not expected Mr. Glasgow was crossing the water to thresh and ridicule "old Englishmen" in the way he had done. But there were grave mistakes in the paper; and these he proceeded to try to rectify. Mr. West was careful to make it quite clear that he had never said a word publicly either for or against carburetted water gas; and he made it equally plain that he was a "low-grade man," though not in all cases—his views depending on the locality and the materials to be carbonized. But when he told those present that he would not use carburetted water gas if he could do without it, or unless it could be proved to be an advantage in producing more light economically, he as good as announced that the influences would have to be very considerable to turn the preferential balance against coal gas.

Aiming with more directness at some of the points advanced by the author, Mr. West described the paper as a clever one, and acknowledged Mr. Glasgow's ability; but he was far from admitting that, clever as the paper was, and great as is Mr. Glasgow's ability, that gentleman had made out a good case. He then explained how it was that increased cost had turned gas engineers from cannel enrichment (where enrichment was necessary) to other methods, succeeding with a reference to vapour enrichment, and to that "improper" instrument, the portable photometer. This brought Mr. West to the portion of the paper in which Mr. Glasgow introduced into his argument the special tests that were made by Dr. Clowes with the portable photometer in London, and from which he asserted that the illuminating power of the gas supplied by the South Metropolitan Company was only equal to 14·68 candles in the 16-candle days. Upon these tests, Mr. West held that it is unfair to assume that in the South Metropolitan district less than 16-candle standard gas was being supplied; and it appeared to him that Mr. Glasgow had tried—although Mr. Glasgow did not assert it in so many words—to make the members of the Association believe and understand that the South Metropolitan Company were distributing gas of less candle power than they were compelled to send out by Act of Parliament. Then Mr. West explained the unique and special conditions under which the Company, and the London Companies generally, are working, inasmuch as it might be assumed from the paper that all the official tests are made on the gas-works. This is not the case. As he pointed out, the London gas supply is under the direction of the Gas Referees, who stand between

* Since this article was written and in type, the number of "Progressive Age" for the 1st inst. has been received; and in another column to-day (p. 680), we give our contemporary's summarized report of the whole discussion at the Association meeting. It certainly does not do justice to Mr. West's remarks, and it may be taken that the other speakers have been equally indifferently treated.

the Gas Companies and the consumers. They arrange for official testing-stations, elaborately fitted up, to test the quality of the gas furnished by the three Companies distributing gas in the Metropolis. The gas is not often tested by the official testers at the gas-works, but at the official testing-stations spread through the different districts. There are, he stated, testing-stations where the South Metropolitan gas is tested nearly 4 miles from the works. Mr. Glasgow, he thought, wanted the members to think or believe that the gas had, at the time to which he referred, been sent from the works vaporized, and that it did not reach the consumers of the prescribed 16-candle standard. But, he pertinently asked, what had the official examiners said on the point. They stated that they had tested the gas supplied by the Company throughout the whole area of their district, and found it to be 16·58 candles. The tests at the gas-works for the half year to June, 1901, showed 16·77 candles; and the official tests at the prescribed testing-places were fully ½ candle more than Parliament then insisted that the Company should give. What, he asked, on this evidence became of the assumption and statement introduced by Mr. Glasgow in his paper? Then Mr. West told the story of how Dr. Clowes and others had tested the gas at what he called "illegitimate places," with the peripatetic photometer—in places where the gas had not been burnt for some time, and where it had been lying dormant in the mains and at dead-ends for several days. "These," Mr. West scornfully said, "are the tests which Mr. Glasgow brings before you for comparison here." The South Metropolitan Gas Company had protested against this improper testing of their gas; and he maintained that they had fulfilled every obligation to Parliament and to the public.

The character of the gas the Company were supplying came in for notice next; and the (for the time being) champion of South London practice informed his American friends that the Company did not supply carburetted water gas, but, when they were called upon to work to a 16-candle standard, they had to sacrifice for quality the volume of their coal gas per ton of coal. Following this, he urged that an answer should be given to the question as to what was the calorific power of the 16-candle gas the Company used to supply—lamenting the fact that Dr. Clowes had not tested the calorific value, and placed the result beside the illuminating power obtained by the roving photometer. He also traversed the advantages suggested by Mr. Glasgow, on behalf of carburetted water gas, on the point of coke—very properly contending that its value depended entirely upon that of locality; and, in the case of the South Metropolitan Company, the extra coke they had for sale through not making carburetted water gas did not trouble them. He also announced his ignorance—until he read Mr. Glasgow's paper that noxious products were more vicious in ordinary coal gas than in carburetted water gas.

Then Mr. West came across these statements in the paper: "Elaborate determinations have been made by numerous skilled observers of the 16-candle power gas as actually supplied by the Gaslight and Coke Company, compared with a similar mixture of 14-candle power, tested by the method prescribed for the 14-candle power gas of the South Metropolitan and the Commercial Gas Companies. . . . The 16-candle power gas and the special 14-candle power gas consisted of two-thirds coal gas and one-third carburetted water-gas in each case." He confessed that he did not understand what these elaborate determinations meant; and he inquired whether he was to assume that Mr. Glasgow took gas from the supply of the Gaslight and Coke Company—16-candle power gas—and reduced it by diluting it to 14-candle power, or did he mean that he reduced it by calculation? However, the author took for comparison the 16-candle power gas and a special 14-candle power gas composed of two-thirds coal gas and one-third carburetted water-gas. Mr. West asserted that he knew of no such mixture as 14-candle power gas being composed of two-thirds coal gas and one-third carburetted water gas. It is not the gas made from Newcastle and Durham coals, and it is not the gas that Sir George Livesey is making and supplying in London to-day. Then, he inquired, why the comparisons were made with this special stuff? He could not understand why; and yet all the figures following in the paper were based on this unknown mixture. He contended that the fabric which had been built upon this foundation was unreal and false. If Mr. Glasgow wanted to compare the Gaslight and Coke Company's gas with the South Metropolitan gas, why did he not test the South Metropolitan gas pure and simple? If he had done so, he would have found in South London a straight coal gas, with a higher calorific value in it than he had given credit for to the special 14-candle mixture. He therefore emphatically declared that the whole of the calculations, based upon the mixture, were inaccurate.

Carrying his attack further, Mr. West dealt with the question of burners; and here he stated his belief that he was the first to test the Welsbach burner to see what difference there was in the light given from it with poor and rich gases. When Consulting Engineer for the Plymouth Gas Company, he tested their 15-candle gas with the incandescent burner, and found it gave a very great light. He carried the same burner and mantle back to Manchester, and tested it with 20-candle gas, and did not find much difference in the illuminating power between the two gases. He therefore came to the conclusion that the burner was a fine thing, seeing that with their poor gas in the South they could give the people a much better and cheaper light. In the paper a whole lot of figures appeared as to incandescent effect, flat-flame burners, and that sort of thing. Mr. Glasgow had compared many of these figures with the price that is charged for gas by the Gaslight and Coke Company, at 75 cents per 1000 cubic feet, but had not told the members that Sir George Livesey is supplying gas lower than that—at about 2s. 3d. per 1000 cubic feet, or 55 cents. With a short reference to other matters intervening, Mr. West got back on to his tests with widely different qualities of gas, and alluded to similar tests that were made shortly afterwards by Dr. Stevenson Macadam with 12-candle gas and the 28-candle gas of the Edinburgh Corporation in incandescent burners. He also saw what a great advantage the low-power gas would be to the public; and it was recommended to the Edinburgh Corporation that they should reduce the illuminating power of their gas. Pursuing the case for low-power gas, Mr. West next brought out the testimony of Sir George Livesey that, since he supplied 14-candle gas, the South Metropolitan Company had only had their normal increase in consumption. Sir George, he pointed out, studied his consumers, and gave them new burners, so that they could get every possible advantage out of the gas. And, said Mr. West, "I have no doubt whatever that through the action Sir George Livesey has taken in his district to-day, with 14-candle power straight coal gas, he is giving better light to consumers than they are getting from other companies where they have not given them these modern and improved burners." Once more Mr. West asked Dr. Humphreys, as representing the author, what the calorific value of the gas supplied by the South Metropolitan Gas Company was when they were supplying 16-candle gas. But he did not wait for the reply, and himself declared that it was about 600 British thermal units, which is higher than the figure given by Mr. Glasgow for the Gaslight and Coke Company's 16-candle mixture. He further asserted that to-day the South Metropolitan Company were supplying 14-candle gas of a calorific value of about 600 units. This quality gas he had himself made at Maidstone and elsewhere, from the same kind of coal that the South Metropolitan Company are now using.

Mr. West's final words were: "Why have we tried to reduce the standard? Why have we gone into this low-grade gas? Some of us worked under an old dispensation in years gone by. We obtained as much gas as possible out of the coal, and made a large volume of gas from Newcastle and Durham coal, of 14·5-candle power—a large volume of good calorific value. But the wiseacres stepped in, and said: 'You must put the illuminating power up.' We objected; but it was imposed upon us, and we had to use cannel coal. We did not like that; as it was too expensive (so far as I was concerned) at Maidstone, Stroud, and other places. In some of these places, we have been relieved of these obligations by convincing Parliament that they were wrong in imposing them upon us. We have got back again; and in Stroud I was the first to get the reduction after Sir George Livesey. Mr. Corbet Woodall assisted me in Parliament in maintaining the old candle power for the Stroud Gas Company, simply because we did not want to go to the expense of getting cannel coal into the place, or putting in carburetted water-gas apparatus, and thereby increasing the capital expenditure for the sake of one candle. At these places, we sell gas cheap—at Maidstone, about 50 cents per 1000 cubic feet; and at Plymouth, at less than half a dollar. What you gas engineers want to aim at is to go in for getting all the gas you can out of your coal. Drive your gas off at high temperature, and do as I have recently done in Germany, and you will get an increase of 1000 cubic feet more per ton of coal carbonized. The higher the temperature, the greater the permanency and calorific value obtained. The question is, How many units of light and heat you can get out of a ton of coal with quick heats and working off good charges. That is the way I advise you men to look at the question—work up your heats, get decent coal, and get what you want out, if you can, in one distillation only; and, if you cannot, get enrichment." A reply was made here by Mr. Humphreys; and then Mr. West was courteously asked whether he had anything that he would like to add. To this, he replied: "I have had my say, and Mr. Glasgow has had his. I do not accept his conclusions. He has not made any calculations of the extra 1000 cubic feet of gas I get out of the coal; and he must take that into his calculation when he estimates the cost of the Gaslight and Coke Company's gas. I am satisfied of that. If Mr. Glasgow were here, I should receive the greatest possible courtesy and attention from him. If he replies to the statements made by me, and any of them are erroneous, I will, if you will permit it, correct any of the statements I have made. If I have made any misstatements I will not only admit that I am in the wrong, but will apologize for it."

As mentioned above, a reply was made by Dr. Humphreys, but we have not the opportunity yet of presenting more than the outline report which appears in "Progressive Age" (see p. 681). It will be hoped by many that the opportunity will be afforded, as early as possible, by Dr. Humphreys, of publishing a full account of his reply.

The Manufacture of Cyanide.—At the meeting of the London Section of the Society of Chemical Industry on Monday last week, Dr. J. Grossman, of the Harpurhey Chemical Works, Manchester, read a paper in which he described a new process whereby ferrocyanide could be economically converted into pure cyanide.

ELECTRIC LIGHTING MEMORANDA.

The Leading Cases of Willesden and Watford—Municipal Electricity Supply to be Abandoned—The Cause of the Ratepayers—The Repentance of Marylebone.

THE decision of the Urban District Councils of Willesden and Watford to sell their electric light undertakings to the North Metropolitan Electric Power Distribution Company has seriously discomposed the newspaper partizans of municipal trading. Naturally, this action on the part of the Local Authorities in question is dead-against the presumption of Progressivism that municipal trading is always better for the public than company supply of a necessary of life; and the journalistic defenders of the "principle" of municipal trading feel constrained to rush into the breach thus opened. Unfortunately for their cause, however, these organs of Progressivism are foreign to the localities concerned, and have blundered badly in their attempts to disparage the wisdom of the Local Authorities' decision. The "Daily News" plunged last week into a protest against the Willesden transfer, which it proceeded to denounce as having been schemed in the dark, and carried through with "unseemly haste;" the truth being that the transaction has been on the carpet in the most public manner possible since last April, when the Council agreed to the recommendation of their Electrical Engineer, Mr. Ruthven Murray, to accept the Company's offer. It is only the London organ of Progressivism, therefore, that has been in the dark, not the ratepayers of Willesden. A still more comical blunder in regard to the same proceeding has been perpetrated by the "Municipal Journal," which blandly assures its readers that the incident really does not matter, and need not disturb the Progressive mind, inasmuch as "the circumstances which favoured it are not likely to recur with any other municipal body in the country." Meanwhile, the transaction was being repeated by the Watford District Council. The balance of probability in this respect is rather with the view of an electrical journal, that "the transfer of small undertakings by sale to neighbouring power companies is a thing which will no doubt be heard a good deal more of later on—not only in the Home Counties, but all over England." That is, of course, assuming that the electric light and power companies necessary to relieve the ratepayers burdened with these unprofitable ventures exist everywhere, and are willing to oblige in this way.

The truth of the matter is, substantially, that victimized ratepayers are becoming restive under the galling disillusionment that most small electric lighting undertakings have brought upon their municipal owners. And where the rates are increased at both ends to keep electric lighting going, the contributories are not comforted by the windy generalities that pass for Progressive politics. Whatever may be the intrinsic worth of the valuable opinions of newspapers, these do not help to fill the ratepayers' pockets. It is easy enough to profess Progressivism when one lives by it, but does not pay for it. In the particular case of Willesden, no small degree of credit is due to the majority of the Urban District Council, and to their professional advisers, for the businesslike spirit in which they have repaired their losses on electricity supply and faced the facts of the situation. Having ascertained that the purchasing Company were able and willing to supply electricity in the district cheaper than they could do it, the Council closed with the advantageous offer. It was the same at Watford, which has hitherto lost heavily by electric lighting. Though political doctrinaires (who pay no rates) may rave over these defections from the ranks of municipal traders, really and truly, the Local Authorities of Willesden and Watford have thereby done more to justify public confidence in the principle of local self-government than anything else that has happened in this connection of late years. Prudent and sensible men have almost given up municipal administration as a hopeless muddle of folly and jobbery. The sane proceedings of Willesden and Watford in "cutting their loss" comes across the annals of local government like a breath from the fresher and freer air of the market-place, bringing with it hope of the purification of council chambers from the stifling atmosphere of demagoguery. Once let it appear that local authorities, like other organizations, can repair a blunder, and they will stand ever so much higher in the esteem of men of affairs, and be more trusted by ratepayers.

The crucial example of municipal ineptitude now before the tribunal of public opinion is the case of the Marylebone Borough Council and their electric lighting question. It has been recorded that the Council are promoting a Bill to obtain the powers necessary to the carrying out of the order of the Court in their arbitration with the local Electric Lighting Company; and at a meeting of the Council on Thursday, a petition most influentially signed was received and supported by a strong deputation, with the object of prevailing upon the Council to drop the scheme, and "endeavour to come to an understanding with the Company to relieve the borough from the present arrangement." Few petitions of the kind have ever received such a list of signatures. The comparison between the standing of the members of the old Vestry, who started the affair on their own responsibility, without consulting the ratepayers, and the petitioners who are now up in arms against the result of this most ridiculous proceeding, is a striking illustration of the character of London, as regards self-government. The ratepayers of Marylebone had kept aloof from Vestry matters, with the exception of a small and mostly inconsiderable minority. The latter were left to do the road-sweeping and the other routine work of the parish in their own way; and the lordly owners and occupiers of the houses in the great squares, and the historic streets of this West End region, took no interest in these things. The time came, however, when the busybodies and the small fry of the Vestry involved the parish (afterwards the borough) of Marylebone in a perfectly mad project, entailing an outlay of about a couple of million sterling for a property not worth to the ratepayers half the amount. Then the great people woke up, and took the trouble to participate in an agitation; some of them even going the length of waiting on the Council as members of a deputation. It was unprecedented. It was also magnificent; and there was more than a little acidity in the language with which the Mayor welcomed the deputation as a sign that "interest has been stimulated in quarters where stimulus was required."

The only question that will now remain is, Was it really business? The first proceeding of the Council after the deputation had withdrawn was to receive and carry a motion to affix the seal of the Council to the petition for leave to introduce the Bill. Immediately after this, however, a new member moved the appointment of a Committee of three to confer with the Metropolitan Electric Supply Company with a view to an arrangement being arrived at to remove the present deadlock. Eventually, after much discussion, an amendment to the proposal was carried, which definitely instructed a Committee to meet the Company, with the object of ascertaining the terms and conditions on which the latter would agree to set aside the award. This, therefore, is how the matter rests for the present. The Marylebone Borough Council, having been made formally acquainted with the bent of public opinion in the borough—which they should have consulted long ago—now desire to back out of the calamitous situation in which the foolishness of their predecessors landed them; and the only question is the price to be paid for the blunder committed. And it must not be forgotten that the origin of the whole trouble was simply the petty, carping animosity of a few busybodies, such as are to be found on public bodies everywhere, against a statutory Company who were doing their duty. If there were any validity in the remedy of surcharging, certain members of the old Vestry ought to be made to pay the piper here.

THE CONCILIATION (TRADE DISPUTES) ACT.

THE fourth report by the Board of Trade of proceedings under the Conciliation (Trade Disputes) Act of 1896, which was issued last week, deserves some notice, seeing that the measure in question constitutes an attempt—though perhaps so far not a brilliantly successful one—to cope with a subject of very great difficulty, and at the same time of first-rate importance. The first report published dealt with the ten months immediately following the coming into operation of the Act; but the second and third each covered a period of two years. This also is the case with the one now before us, which deals with the two years ending June last. It will be remembered that the object of the Act referred to is to make provision for the prevention and settlement of trade disputes. In addition to providing for the registration of Conciliation Boards, it enacts that, where a difference exists or is apprehended between an employer, or any class of employers, and workmen, or between different classes of workmen, the Board of Trade may, if they think fit, exercise all or any of the following powers: (1) Inquire into the causes and circumstances of the difference; (2) take such steps as may seem expedient to enable the parties to meet, under the presidency of a chairman mutually agreed upon or nominated by the Board or some other body, with a view to an amicable settlement; (3) on the application of employers or workmen interested, and after taking into consideration the existence and adequacy of means available for conciliation in the district or trade, and the circumstances of the case, appoint a person or persons to act as conciliator or as a board of conciliation; or (4) on the application of both parties to the difference, appoint an arbitrator.

During the period which the present report covers, 41 cases have been dealt with, in 21 of which a cessation of work was involved. In the preceding two years, there were 46 cases; while the total number in the period of nearly seven years which has elapsed since the passing of the Act amounts to only 154. It will thus be seen that it is in but a very small proportion of the total number of disputes that the Board have been able to exercise their powers; and in practically 50 per cent. of the cases they have so dealt with, their intervention was the outcome of applications made by both masters and men. Of the cases in the period under review, the building trades alone were responsible for sixteen—indeed, since the passing of the Act, more than one-third of the disputes dealt with by the Board have arisen in this branch. During the past two years, 29 disputes have been settled under the Act; in the remainder, the parties came to terms during the negotiations, or the Board refused to interfere or were unsuccessful in securing an agreement. In two instances out of the 29 cases mentioned, the settlement was effected by the appointment of conciliators by the Board; and in the rest, by arbitration.

The most important case which went to arbitration was the disastrous dispute in the Grimsby fishing trade, in which, after

a bitter struggle extending over three months, the parties applied to the Board, who appointed Sir Edward Fry arbitrator. There was, however, subsequently another dispute, on a different point, but in connection with the same industry; and with regard to this case, it is unsatisfactory to learn that, though an arbitration was held, the men have not up to the present time carried out the terms of the award—which, it is needless to add, was in favour of the employers. The Owners' Federation informed the Board that the dock labourers refused to accept all the conditions of the award, and inquired if any course of action lay open to the Board. They, however, replied that the Act conferred no compulsory powers on the Department. The General Secretary of the National Union of Gas Workers and Labourers—the organization involved—stated that the Executive had done all they were called upon to do by way of impressing upon the men the necessity of carrying out the award, and that even if the rules empowered them to expel the unruly members, it would not make the slightest difference so far as the question at issue was concerned. This is not the first occasion on which the officials of a Trade Union have shown themselves unable to control the actions of the men on whose behalf they claim the right to speak; and employers might well be pardoned if they respectfully declined to be a party to proceedings by which if the decision went against them they would feel bound, while if it were in their favour the men might calmly ignore it. "Heads I win, tails you lose," as exemplified by the action of the men in this instance, is a very one-sided game indeed; and a few repetitions of the tactics of the Grimsby dock labourers would utterly discredit voluntary arbitration as a means of settling trade disputes. It is stated in the report that, "so far as is known, this is the only case in which an award under the Conciliation Act has not been accepted." If the arbitration provisions of the Act are not to be rendered quite useless for all practical purposes, it is to be hoped that it will remain so.

Among the cases in which, during the period dealt with by the report, the Board declined to take action, the most prominent was the dispute at the Bethesda Slate Quarries. There the men, two years after the commencement of the stoppage of work, applied to the Board for the appointment of a conciliator; but the Board, having come to the very wise conclusion that no action which it was in their power to take would have any probability of facilitating a settlement, refused to comply with this request. This strike is now happily at an end—the men having gained nothing by their long fight but dearly bought experience—but it may not be out of place to remind workmen that the proper time to invoke the aid of "conciliation" is not after they have for a year or two carried on a struggle in a way best calculated to embitter the relations between them and their employer. The main object of the Act is not to afford Union officials an opportunity of conveniently glossing over the fact that they have been beaten, but to avoid, as far as may be practicable, that kind of industrial warfare which is most harmful alike to the interests of masters and of men.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see page 700.)

BUSINESS on the Stock Exchange last week was not very brisk; the fortnightly settlement being the chief object of attention, although it was not a heavy affair. Of course, the general position has been overshadowed by the war cloud hovering over the Far East. But in spite of sinister incidents, there was a persistent undercurrent of feeling that somehow or other actual hostilities would be avoided; and thus prices have kept up better than they would if supported by a lively faith. In fact, some markets have done pretty well, and closed at an advance. In the Money Market, there was not a superabundant supply to meet the demands of the Stock Exchange and other requirements, and rates ruled firm, but discount was easier. Business in the Gas Market was a good deal more slack than the week before; and one or two days almost approached a blank. Movements in quotations were quite irregular, and governed apparently by ephemeral circumstances; but, on the whole, there were more shrinkages than expansions. The end of the year is now close at hand; and we have had hardly any really wintry weather to stimulate the consumption of gas. Nevertheless, when the half year's accounts come out, the Companies will very likely be found to have done not at all badly. In Gaslight and Coke issues, the ordinary was only moderately active, and was at first not over and above strong—changing hands once on Monday at 86½. However, it soon ran away from these figures and repeatedly commanded 88½; the quotation marking one point up. The secured issues were rather quiet, and fairly steady, though the debenture lost a fraction *ex div.* South Metropolitan was not in good favour, offers being in excess of buyers; and on Saturday a parcel was let go specially at 116½—the quotation closing at a loss of three points. The debenture stock too was lower. Commercials were quiet. It is believed that the quantity of stock lately thrown on to the market has been absorbed, and the market will go steadier. The debenture stock was a little better on *ex div.* adjustment. Very little was done in the Suburban and Provincial group; but some Brentford and West Ham stock was let go cheap, and the quotations went accordingly. The Continental Companies were not active, and prices were unchanged. The remoter undertakings gave no sign. In the Water Companies, business was almost at a standstill; operations being pretty well paralyzed by the proceedings in the Arbitration Court. There was very little change in the quotations of the ordinary stocks; but debenture and preference stocks were put down freely. The Chelsea Company will pay a higher dividend—at the rate of 12 per cent.

The daily movements were: No change in Gas on Monday. In Water, Grand Junction fell 1. On Tuesday, West Ham declined 1½. In Water, West Middlesex dropped 5, and New River debenture 3. On Wednesday, Gaslight ordinary rose 1; but South Metropolitan fell 1. On Thursday, Brentford new moved down 2. In Water, there was an almost general shrinkage in debenture stocks. On Friday, South Metropolitan was 1 lower. In Water, Southwark fell 5, and there was a further relapse in debenture stocks. On Saturday, there was another fall of 1 in South Metropolitan ordinary and debenture.

PERSONAL.

A handsome case of plate and cutlery, suitably inscribed, has been presented to Mr. G. H. JUDD by the employees of the Crays Gas Company, on his resigning the position of Assistant-Manager, and leaving the Company's service to enter upon his duties as Manager to the Sheringham Gas and Water Company.

The last issue of the "American Gaslight Journal" to hand contains the first portion of their abstract report of the proceedings at the annual meeting of the American Gaslight Association, held at Detroit (Mich.) in October. We allude to the matter here in order to supply an omission in the list of officers of the Association, given on the authority of our contemporary, in the "JOURNAL" for the 10th ult. We are pleased to be able to record that Mr. A. E. FORSTALL, of Montclair (N.J.) still fills the dual position of Secretary and Treasurer.

On Friday, the 4th inst., Mr. GEORGE NEWTON, of Messrs. George Newton, Limited, Oldham, was presented with a handsome complete case of cutlery and plate, the gift of the Directors of the Richmond Gas Stove and Meter Company, Limited, on the occasion of his wedding, which took place recently at Oldham. The presentation was made by Mr. J. A. Ransome, the Managing-Director of the latter Company, who referred to the high regard in which Mr. Newton was held by all who knew him, and said he started his married life with every prospect of a long and useful career, which they hoped he would realize.

OBITUARY.

The death occurred on the 3rd inst. of Mr. HENRY LOFTS, the Chairman of the North Middlesex Gas Company. The deceased gentleman (who was 75 years of age) had been a Director of the Company for 33 years, and Chairman for the past six years. The event was feelingly alluded to at a meeting of proprietors held on the 9th inst. Mr. Lofts possessed a genial and kindly presence, and was widely esteemed. Mr. ARTHUR MATTHEWS PADDON has been elected Chairman of the Company in his place.

Mr. DAVID PURVES, the Convener of the Works Committee of the Edinburgh and Leith Gas Commission, whose condition was reported in our "Scotch Notes" last week to be very grave, died on Thursday. He was head of the firm of Messrs. D. Purves and Co., plumbers, brassfounders, gas-fitters, and electric light contractors, who carry on an extensive business in Edinburgh. He has been a member of the Edinburgh Town Council since 1897. Having been appointed by the Council to be one of their representatives upon the Gas Commission, he was by that body, on the failure of the health of Mr. W. Kinloch Anderson, requested to take charge of the Works Committee. Upon Mr. Anderson's death, he was appointed Convener of the Commission. During his term of office in that capacity, the greater part of the work in connection with the erection of the Granton Works has been executed. Mr. Purves was highly suited for such work, and he bestowed much time upon it. He was a veritable right-hand man to the Engineer. Mr. Purves was also a member of the Dean of Guild Court of Edinburgh (which deals with plans of all buildings proposed to be built or altered), and of the Edinburgh and District Water Trust. At meetings of both of those bodies since his death, highly appreciatory remarks have been made regarding his public life. His remains were buried yesterday (Monday) in the Grange Cemetery, Edinburgh; the funeral being a public one, attended by the Town Council, the Gas Commission, the Water Trust, and other bodies with which he was connected.

Distribution of Rainfall over the British Isles.—At a meeting of the Institution of Civil Engineers on the 24th ult., Dr. H. R. Mill read a paper on the above subject. The results were based on the means of thirty years, 1870 to 1899, and they showed that a mean annual fall of less than 25 inches occurs in only three places (one being a triangular area about the Thames estuary), and that the amount increases in various districts, in which altitude and configuration of the land form important features, to 40 inches and upwards.

THE COMPLETION OF THE NEW WORKS OF THE SHREWSBURY GAS COMPANY.

THE new works of the Shrewsbury Gas Company have been completed, and gas making commenced in them on Nov. 24. The date is of interest, because it was only on Nov. 29 last year that the contract was let to Messrs. Robert Dempster and Sons, Limited; and, notwithstanding that the weather during the year has not inclined favourably towards smart execution of building and engineering work, they succeeded in taking the rugged site in hand, and, conformably with the plans of the Engineer (Mr. William Belton), set up, from beginning to end, within the twelve months, a manufacturing plant of a capacity of 500,000 cubic feet per day, which capacity the Engineer anticipates will eventually be exceeded. Even at this early stage of the working, it has met the output for which it was designed. The performance is a creditable one to all concerned; and this was the opinion of those gas engineers and friends, local and otherwise, who were invited last Tuesday to inspect the works and witness their operation.

The new works were fully described, as the main parts were nearing completion, in the "JOURNAL" for July 7 last; and some interesting photographs were then given showing portions of the works in process of construction. The finished plant at work was what the visitors of last Tuesday saw; and we leave their expressed opinions to the representative and voluntary statements made, as reported in brief at the close of this article.

When writing in July, the old works invited some attention, as they illustrated a long past day in gas engineering, with intersertions of modern times. The position of the old works showed that, while they are not by any means played out yet, and will serve as an auxiliary to the new works in the winter months for some time to come, the Company were bound—in order to meet their obligations and the growing business, and to gain economies in working—to put up complete new works. The facts that the Company had an independent site available for new works, and that the site is capable of, and has been plotted out for, a considerably larger development than is already represented by the new works, were also explained. This leaves us free in this introduction to the account of Tuesday's visit, to give some

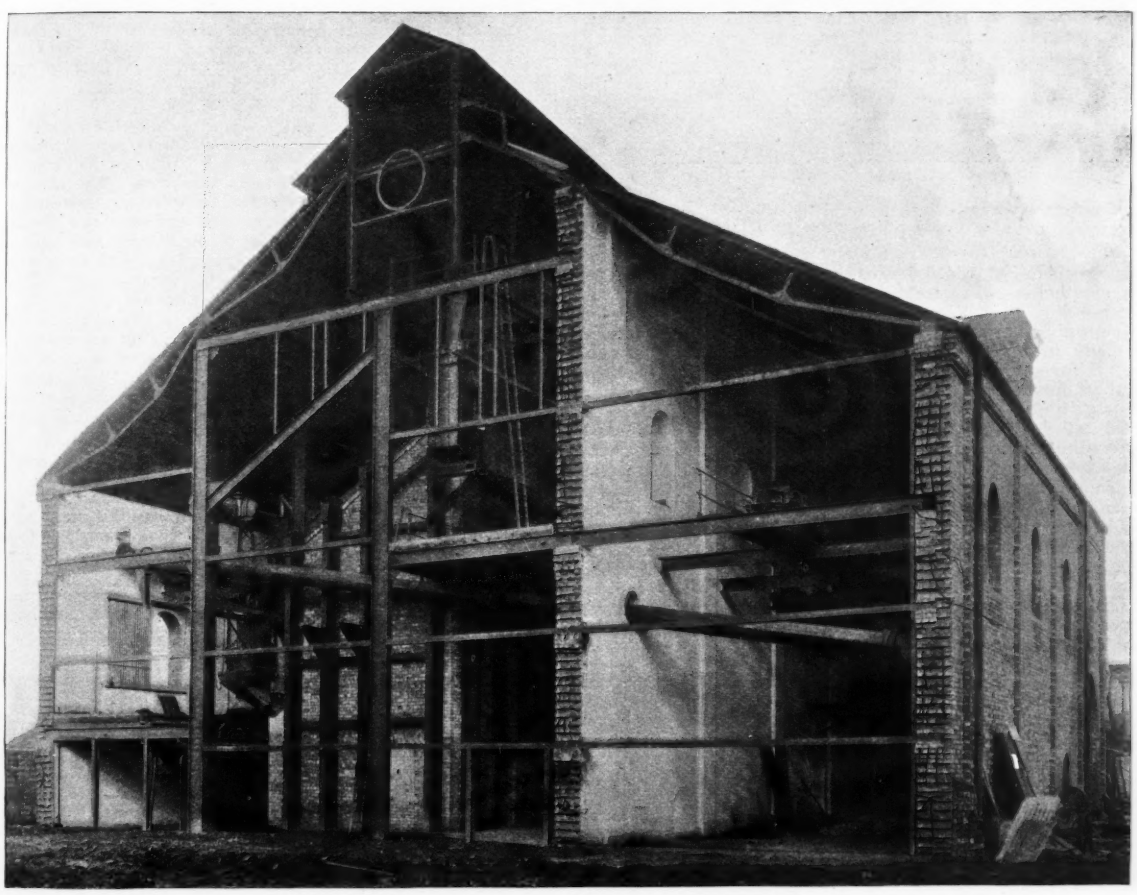


FIG. 1.—GABLE END OF THE INCLINED RETORT-HOUSE AND COAL-STORE BEFORE THE TEMPORARY GALVANIZED IRON SHEETING WAS FIXED. THIS ILLUSTRATES THE PATENT COMBINATION OF ROOF, COAL-HOPPER, AND CONVEYOR, WHICH REDUCES THE HEIGHT OF THE BUILDING.

figures then collected showing how the gas consumption has expanded in a noteworthy manner, although Shrewsbury is only a residential town, and (in dealing with the retort-house) how the new works will, by an equally noteworthy reduction of manufacturing expenses, contribute to still further prosperity.

A dip into the Company's accounts reveals that there has been a masterly handling of the commercial side of the business during the past quarter of a century. The Company's financial year ends on June 30; and we find it was in the year 1879-80 that the works came under the charge of Mr. Belton. The statistics show that in that year, the gas accounted for amounted to 77 million cubic feet; while the quantity accounted for in the twelve months ending June last was 164,500,000 cubic feet. If we take the figures for the decennial periods (although occasional years have not yielded an increase owing to changing meteorological conditions), there is found a remarkable consistency in the advancement of the business. In 1863, the gas made was 34,300,000 cubic feet; in 1873, 66,337,600 cubic feet; in 1883, 105,788,400 cubic feet; in 1893, 139,851,500 cubic feet; and in 1903, 173,777,000 cubic feet—the increases at the end of each decade being, 32,037,600 cubic feet, 39,450,800 cubic feet, 34,063,100 cubic feet, and 33,925,500 cubic feet. Always between 32 and 40 millions increase! Now in the current year, from July to November, there has been an augmentation of the consumption by about 4 millions; so that, at the present time, for a Company serving a district of this character, and with a dependence on private consumption and favourable consumption-promoting conditions of weather, things are going ahead at a very respectable rate, showing that the new works, apart from other considerations, were not taken in hand any too soon. Cooking-stoves and slot meters are two branches of the business that have been diligently cultivated. And there is an interesting comparison to be made here bearing upon the influence of the stove consumption. Take January, 1879 (it is important to notice the months here), the output was 11,883,000 cubic feet. In January, 1903, it had reached 22,391,300 cubic feet. This shows that the monthly consumption of gas in one of the coldest months of the year nearly doubled in that period. But the figures for July—one of the warmest and lightest months of the year—tell an even more gratifying tale. In July, 1879, the make was only 2,893,000 cubic feet, and in July, 1903, it was

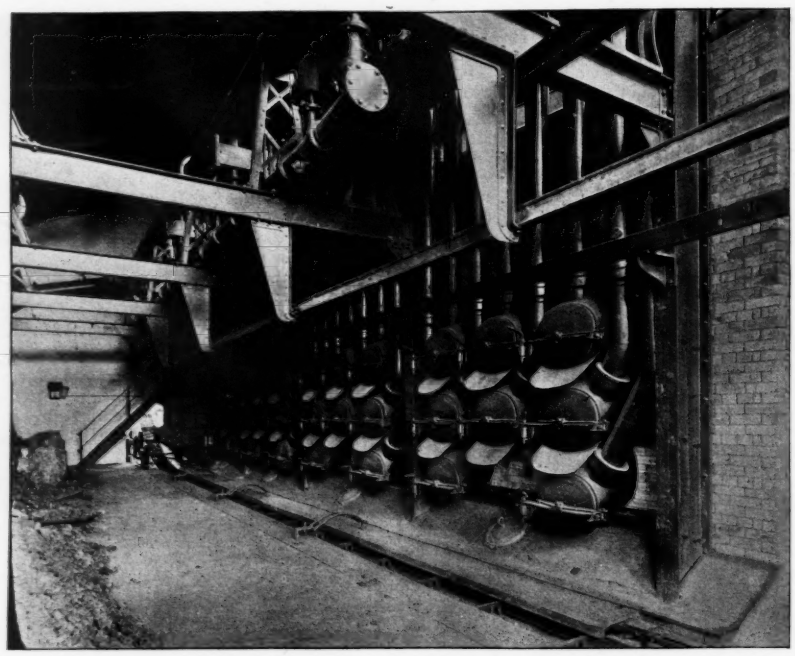


FIG. 2.—DISCHARGING SIDE OF THE INCLINED RETORT-HOUSE, SHOWING DEMPSTER AND SONS' "PERFECT" HOT-COKE CONVEYOR.

9,263,000 cubic feet, which figures show that the consumption for that month more than trebled that of the similar period. In other words, it reveals the effect of the cooking-stove work upon the consumption; and indicates that the summer consumption has made an advance of 50 per cent. over the winter consumption. This is a result directly traceable to the development of the stove department.

For a detailed description of the works, the reader must be referred to the article published in July; but some supplementary points were gathered during the visit last Tuesday which may be of interest. The men's mess-room, lavatories, and washing and shower-bath rooms were first inspected; and there was agreement among the party that few works of the size can be found better fitted for providing comfort for the men. The inclined retort-house came next under examination and inquiry from ground floor to roof. From outside was seen how the southern end of the building has been merely covered by galvanized iron sheeting on a steel joist framework (fig. 1) in order to permit of extension in future with the minimum of interference with the structure and working. From the outside too, it was observed that the building is (we think we may say) the lowest in the country that is occupied by inclined retort-settings; and inside it was seen how 20 feet in the height of the building has been saved by the adoption of Messrs. Dempster and Sons' patent combination of coal hopper, conveyor, and roof, as formerly fully described. In the ground-floor part of the house, Waddell's patent regenerator furnaces were inspected and seen in action; and Mr. Belton informed inquirers that, from his present short experience, he has nothing but a satisfactory account to give of their operation. Ascending to the discharging-floor (fig. 2), the four settings of eight 20-feet tapered inclined retorts were seen and their fittings examined. The 32 retorts were estimated to produce 500,000 cubic feet of gas per day; and this point has already been attained, without the slightest pressure. Retorts in different settings, and in each horizontal line, were discharged; and it was very pleasing to see the way that the charges slipped out without any hesitation. With a six-hour period of carbonization, the charges were found to have been burnt off in an excellent manner.

A few words about the charges. The coals used are North Wales and South Staffordshire washed nuts; and from the tests made by Mr. Belton in the test plant (upon the usefulness of which we remarked in the July article), these coals are shown to possess similar characteristics and productive capabilities. The tests are not made from samples, but from bulk on delivery. The retorts, so far, have been charged according to the heats, which have not been hurried up to a high pitch. Charges of 7½ cwt. are being used just now; and, with 8 cwt. ones, the retorts will reach their allotted capacity. Charges of this weight have been dealt with during part of the short time the house has been in operation. But with the old works running, there is plenty of margin to allow of ease in the early days of the inclines, so as to get them well seasoned, and the men well trained to the work, before pushing to gain the last fraction of economy. Another feature on the charging-floor that claimed special attention was Dempster's patent hot-coke conveyor, which has also been described. It was working well, and it was a matter of comment that the coke was passed by it from the house without any perceptible damage.

Passing up the stairway, the charging-stage (fig. 3) was next inspected; and the feeding of the retorts, the discharging of which had been just previously witnessed, was seen. The charging is performed by three separate machines (one for each horizontal row of retorts), running on light overhead rails; each charger being fitted with Dennison and Broadhead's weighing-machine. The arrangement attracted considerable interest, and its usefulness was acknowledged. The solid character of the settings and the bracing was also noted.

The point regarding the labour is always an interesting one; and it was observed that the whole of the retort work is accomplished by three men per twelve-hour shift. This means that rather more than 80,000 cubic feet of gas per man is produced. There is one man on the charging-floor, and two on the discharging floor; and the three attend to the furnace work. There are also on the day shift two boiler and machine men, but only one on the night shift. These men attend to all the machinery and boilers, including the coal plant. The coal-store, which runs alongside the retort-house, and which contains the breaking, elevating, and conveying plant capable of dealing with 25 tons an hour, was inspected from the charging-floor; and a demonstration was made of the operation of the elevators and distributing conveyors (figs. 4 and 5). Ascending a spiral stairway from the charging-floor, the course of the coal to the overhead hoppers was seen; and the visitors were interested in watching the easy

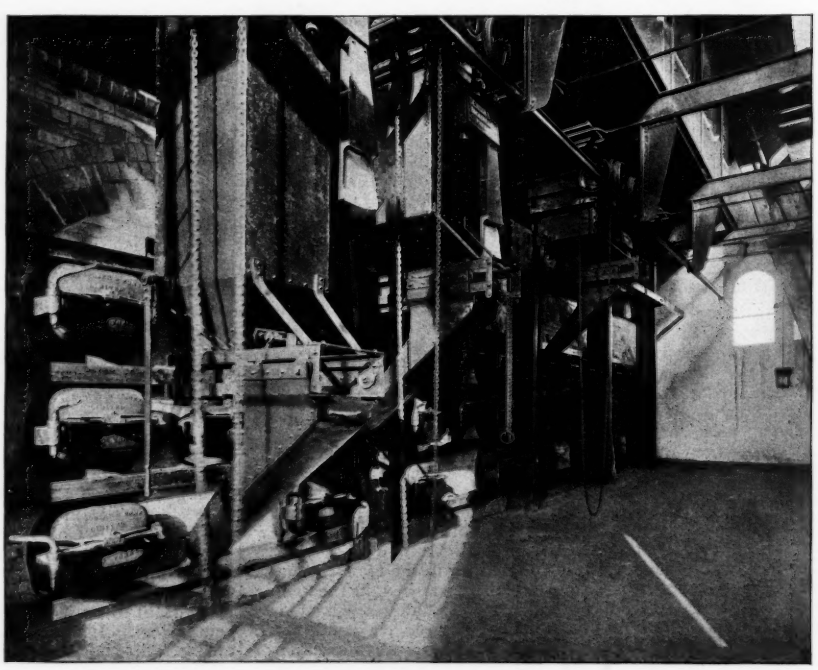


FIG. 3.—CHARGING FLOOR OF THE INCLINED RETORT-HOUSE, SHOWING DENNISON AND BROADHEAD'S PATENT WEIGHER AND CHARGER.

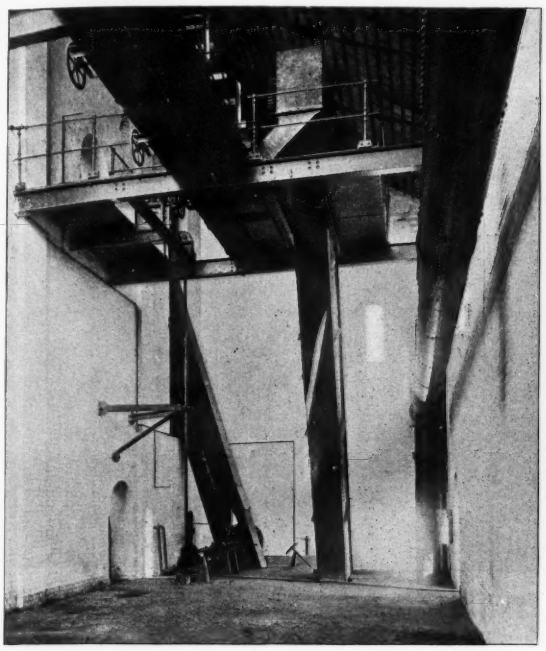


FIG. 4.—COAL-STORES, SHOWING THE ELEVATORS AND OVERHEAD CONVEYOR.

working of the different parts of the plant. The overhead hoppers have a capacity equal to thirty hours' consumption (or more than 60 tons), which is a very liberal provision. The result is that by two o'clock in the day, sufficient coal is stored overhead to carry the house on well over the night shift. The arrangement of feeding these hoppers works well; and it obviates the necessity of the men constantly running up and down to examine the hoppers. Along the hopper tops are openings, which can be opened and closed at will. But they are all kept open; so that, when coal is being delivered to them, it falls into the first hopper. When this is full, the conveyor simply carries the coal over it to the next opening, and so on until the whole of the four hoppers are completely replenished. It is only the last hopper that the men have to watch; so that practically the filling of the hoppers is an automatic matter, and the time of the men is saved. It has been mentioned that the hopper openings can be opened or closed. This will be an advantage in case it is desired to keep separate different qualities of coal.

While referring to the labour employed, it should be stated that, the new works having only been started on Nov. 24, it is too early yet to give any precise information as to the carbonizing charges working with the inclined retort system as compared with the hand work at the old place; and, moreover, the two works are both running at the present time, so that it is difficult to make any exact comparison. When the old works are closed down for the summer, a complete period of operation with the inclines and other new plant will be available; and then we have no doubt that Mr. Belton will be perfectly willing to publi sh his figures. However, it is anticipated, from the present working, that the cost will not exceed 1s. to 1s. 1d. per ton of coal carbonized—that is, for the retort-house and machine men. At the old works, with hand charging, the current cost is 2s. 9d. per ton; and from this it will be seen that a tremendous saving on a year's working will be effected. Of course, with the existing dual working, the difference in cost is only obtained on the tonnage of coal carbonized in the inclines; but the saving spread over the whole make—that is to say, at both works—effected a good difference per 1000 cubic feet of gas made even in the first complete week's working. In the week preceding the commencement of work with the inclines, the total carbonizing costs, including the work on coal and purification, was 3·568d. per 1000 cubic feet of gas made. In the first complete week following the starting of the new works, it was 2·56d. over the whole make, which was about equally divided between the two works; and yet the men on the inclined settings are new hands. This is a good indication of what the reduction in costs will ultimately be when the new plant is working alone. Anyway there is already, under present conditions, a reduction of 1d. per 1000 cubic feet at this early stage of the working over the whole make with both plants. Well, then, it has been costing the Company 0·458d. per 1000 cubic feet of gas for labour on coke. The expenses on this work are unavoidably heavy here. It has to be sent away; and the part which has to go by rail has not only to be loaded on the works and carted, but, when the railway is reached, it has to be tipped on to the ground and loaded into the railway waggons by fork. But in the first complete week's running of the new works, taking the coke dealt with at both the works, the charge mentioned was reduced to 0·311d., so that

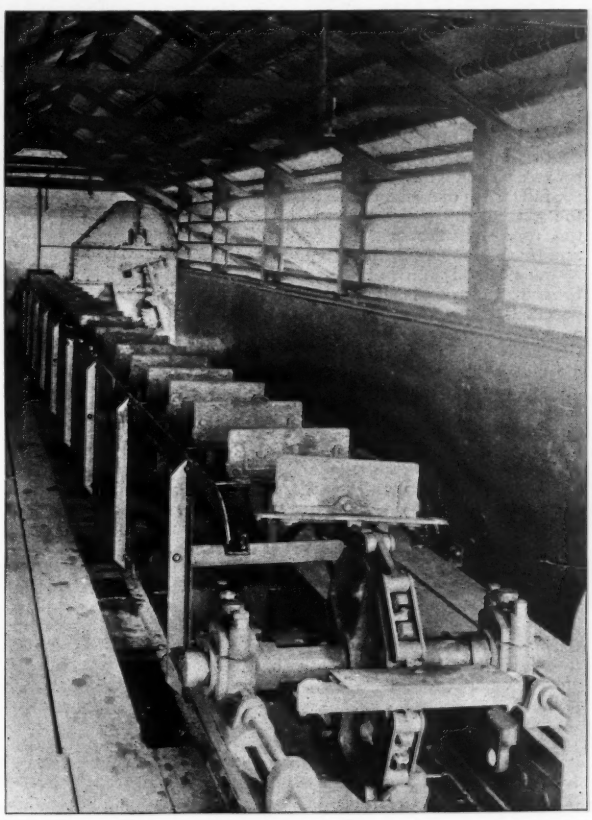


FIG. 5.—TOP VIEW OF THE OVERHEAD CONVEYOR FOR STACKING COAL IN THE STORES.

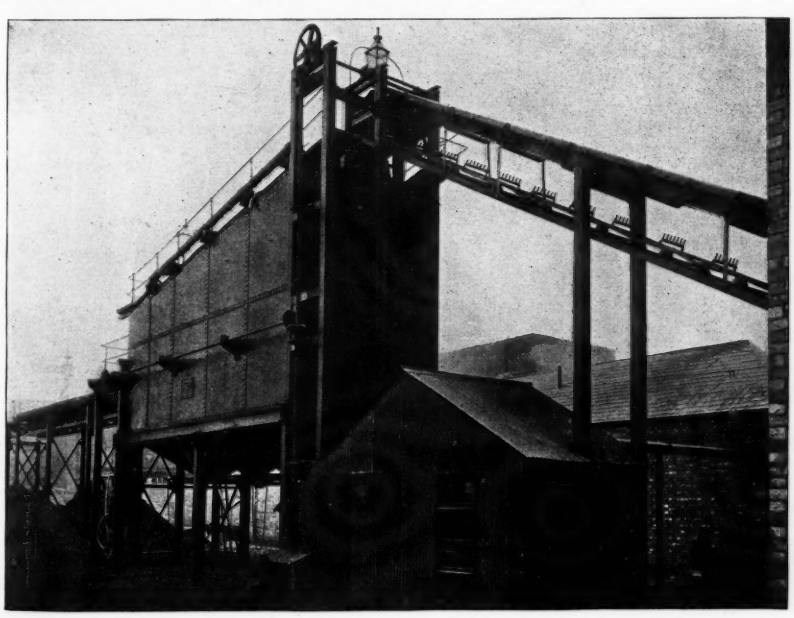


FIG. 6.—YARD COKE PLANT, SHOWING THE INCLINED CONVEYOR, HOPPERS, AND STACKING CONVEYOR.

altogether the Company were better off than before by about 1¾d. per 1000 cubic feet. This is very encouraging for the attainment of the higher economies expected by the Engineer.

The visitors before leaving the retort-house penetrated into the roof to see the coal-conveying plant there; and their investigations must have dispersed any doubts which they may have entertained as to the ventilation of the house, in view of the reduced height. The provision made is proved to be ample. Both on the discharging-floor and the charging-stage, and right away up under the roof of the house, the temperature was not uncomfortable. Ventilation is provided by the openings at both ends of the house, in the side wall of the discharging-floor by an opening 2 feet deep running the full length of the house between the glazed and slated portion of the roof over the charging-floor, and by the louvres in the top part of the roof. It was noticed when the charging and discharging were proceeding, how quickly the smoke and steam passed away, leaving the atmosphere of the house as clear as before the operations were started. In respect of ventilation—judging of course from a December day, but a heavy one, and with rain falling almost constantly—the house will not, it appears, compare unfavourably with the best of other inclined retort-houses in the country of the ordinary height. Neither can complaint be made as to the light. Good provision has been allowed in this regard. The charging-stage, however, would have been rather dark, backing as it does on to the coal-stores, without the skylight the full length of the building; but this, with the end openings, furnishes all the light that is needed.

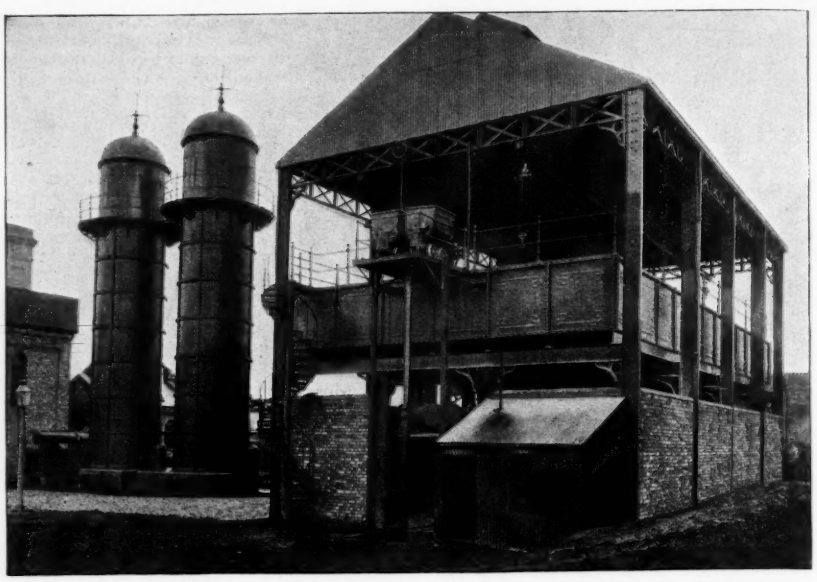


Fig. 7.—Purifier-House, showing the Hydraulic Lift, Scrubbers, &c.

After the retort-house, the party inspected the yard coke plant consisting of the inclined conveyor, the four chambered 80-ton hopper (into which, by means of a rotary screen, the coke is sorted into four sizes—breeze, small, and two sizes of large), and the stacking conveyor beyond (fig. 6). As seen, the coke is loaded direct into carts from the hopper. The plant is driven by a steam-engine situated in a galvanized building underneath the inclined conveyor. The steam-pipes are all carried overhead, and are covered with non-conducting material.

Passing onward, the condensers were next seen; and then the boiler-house containing two Cornish boilers—one being in reserve. Steam, at 60 lbs. pressure, is supplied from here to all parts of the works where required. The exhauster-house, pump-house, washer, and scrubbers came in turn for notice; and then some time was spent over the purifying plant, the general arrangement of this being greatly approved (see figs. 7 and 8). The meter-house was also inspected. To give the details of construction and equipment of these buildings would merely be to reiterate the portions of the article referring to them published in the "Journal" for July 7. In several of the buildings on the works, it was remarked that wall safety incandescent lamps have been fixed. The light is completely enclosed, and the air supply and ventilation are obtained by channels communicating with the outside of the building.

The construction of the buildings and plant has been well done; and the works promise to render good service. They have already shown to the Company the economy that exists in modern methods of manufacture, as compared with those which, through unavoidable circumstances, they have been working with in the past, and which will still do duty when occasion requires. On the completion of the new works, and on their highly satisfactory operation right away from the time the first retort was charged, both Mr. Belton and Messrs. Dempster and Sons must be congratulated.

This article does not pretend to be a complete account of the works, but must merely be read as supplementary to the previous one on July 7.

After exhausting the many features of the works, the party assembled in the Works Offices, where they were received, in the absence of the Chairman (Mr. J. Spencer Phillips), by Mr. E. Calvert, LL.D., the senior Director of the Company, and Mr. Henry Wade, one of his colleagues. Mr. Calvert gave a hearty welcome to the visitors, and said he greatly regretted the unavoidable absence of the Chairman. But Mr. Spencer Phillips, though not present, had sent in writing what he would have had to say to those present. The communication was as follows: The Directors are pleased to meet and welcome this assembly of prominent gas engineers, and trust that what they have seen will have both pleased and interested them. We do not suppose that anything we have to show will appear to be novel to most of those present, unless, perhaps, it is in the construction of the retort-house, which is of less height than usual for its class; but we have endeavoured to make the new works as complete as possible, and as automatic as is compatible with economy of capital as well as of working, as probably most of you would gather from the description and sketches of the works reprinted from the "Journal of Gas Lighting." Of course, we are aware that there are other kinds of gas, and other methods or systems of working, each of which has (no doubt) its adherents; but before adopting the particular system seen to-day we gave careful consideration to these various methods, finally selecting the one we felt to be most suitable for the particular conditions to be met. Since our

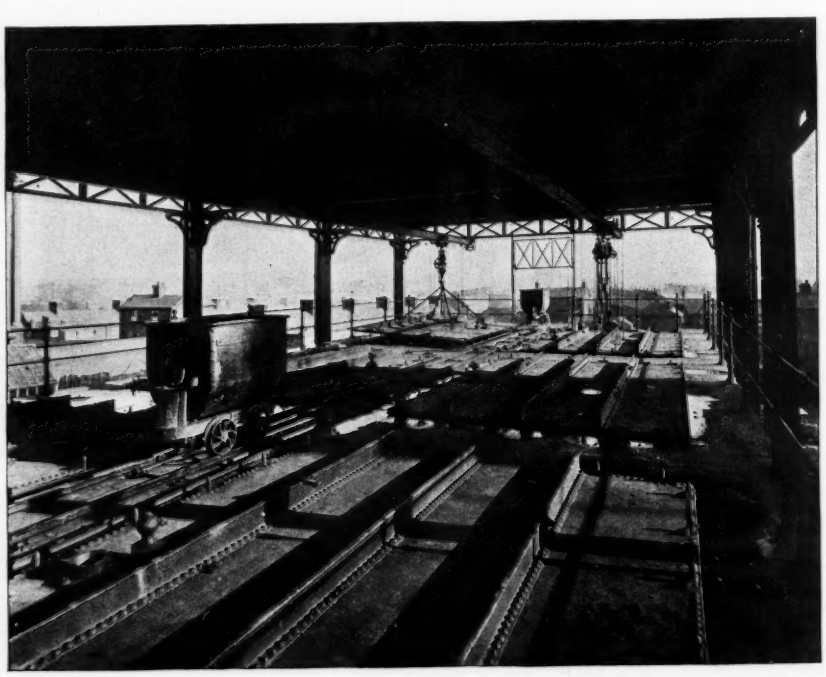


Fig. 8.—View of Green's Purifiers, showing the Lifting Apparatus, Hydraulic Lift, Tip-Waggons, &c.

adoption of this system, you will know that another system of carbonizing, and also another method of charging retorts, have been advocated. These as yet are on probation, or approaching that stage; and it yet remains to be shown whether they will prove to possess any material advantage over what you have seen to-day. These works having only just been put into operation, it is, of course, too soon to speak of results obtained; but we have every confidence that they will fully realize the expectations we have formed of them, and so justify our decision. The plans and specifications have been prepared in our own offices by our Engineer and his staff; and we think there is every reason to be satisfied with the way in which the Contractors have carried out the plans, and with the energy they have displayed in completing and putting the works into operation within twelve months from the letting of the contract, as well as with the careful and substantial manner in which they have performed their task. Messrs. R. Dempster and Sons, Ltd., of Elland, are so well known as reliable Contractors, that it is unnecessary to say more than that we felt sure that any work they undertook would be well executed; and we think you will see the justification of that opinion before you to-day. Of course, there are a few minor matters not quite completed, and the unoccupied space is yet to be put in order; but in a short time we hope to be quite straight, and shall be very pleased if any of you would like to pay our works another visit later on.

On behalf of the visitors, Mr W. R. Cooper (Banbury) said there was a duty they ought to perform before leaving the works, and that was to ask Mr. Calvert and Mr. Belton to accept, and to convey to the Chairman and Directors generally, their warmest thanks for their kindness in inviting them there that day, and also for giving them the opportunity of seeing the developments that the Company had made, and that Messrs Dempster and Sons had brought to bear on the works, which, so far as they were able to see, were in every way satisfactory. The proposition was seconded by Mr. W. Parlby, of Hereford, who also congratulated the Company upon the completion of their new enterprise. The visitors, he remarked, had seen that day some of the most modern developments in connection with the manufacture of gas. They had seen the sloping retorts in action; and, from the facts elicited as they had traversed the works, those present were convinced that the departure the Company had made was one that must result in considerable economy, especially when it was seen that a retort-house making 500,000 cubic feet of gas per day could be worked by three men on each twelve-hour shift. He also cordially congratulated Mr. Belton upon the appearance of the works. He (Mr. Parlby) remembered visiting Shrewsbury some years ago, and then the present site was quite undeveloped. It was now laid down on lines that he thought would enable the Company to meet the requirements of their customers for many years. The name of Mr. J. W. Broadhead, of Messrs. R. Dempster and Sons, Limited, was included by Mr. Cooper in the congratulations. The vote was supplemented by many personal felicitations.

A little later there was a dinner, at the Raven Hotel, at which Mr. Calvert was in the chair, and Mr. Wade in the vice-chair. It was not a large, but it was a very happy party, and the time passed pleasantly. Among the company were those who had been officially identified with the construction of the new works; and it brought out how thoroughly the most perfect harmony prevailed, on the completion of the scheme, between those who were responsible for the interests of the Company and those who had the interests of the Contractors to serve and their reputation to defend in the manner in which the work was carried out and in its ultimate character.

There were a few toasts which all, excepting the loyal one, had reference directly or indirectly to the new works. The features of the speeches may be briefly traced. Upon Mr. Fletcher W. Stevenson devolved the duty of proposing "Success to the Shrewsbury Gaslight Company." He remarked that success seemed to almost constantly follow gas undertakings; and therefore it was difficult to wish them success. But they could most heartily wish the Company continued success in the future. What they had that day seen in the new works (which had been so ably designed by the Company's Engineer and carried out by the Contractors) showed that there was every likelihood of success continuing to attend them. The success of any gas company meant increased consumption, and increased consumption meant a reduced price for gas, owing to the reduced cost of producing the larger quantity. From what had been observed at the new works, this would follow in the case of the Shrewsbury Gas Company, because there they could not fail to produce gas more cheaply than in the past. Therefore the success of the Company would cheapen the cost to the consumers, and would redound to continued success. The toast was heartily honoured. The Chairman's response was brief; but he took the opportunity of acknowledging the high value placed by the Directors on the services of their Engineer and Manager, with whom they felt themselves in tolerably safe water. Reply was next made by Mr. Wade, who, referring to some of the directions in which the Company had met with success, mentioned that, in the previous six weeks, they had taken £630 from the slot meters, or about £100 a week. In the summer months, too, they had an enormous number of cooking-stoves in use, which produced large increases.

The next toast was in the hands of Mr. R. G. Shadbolt; and it was that of "The Engineer." In his remarks, he said that though there was no doubt the incandescent light had played a great part in bringing the gas industry into its present position, it was not the only factor. There had been on the part of gas suppliers, if he might so put it, a keener sense of their commercial obligations, a keener sense of the requirements of the times, and a keener sense in meeting competition and opening up new business. This was what had placed the gas industry in the position it occupied to-day; and what had produced the need for additional works in Shrewsbury. Mr. Belton had, in the new works, met these requirements with a minimum of expenditure and a maximum of efficiency; and therefore Mr. Stevenson might well say that the continued success of the gas industry in the town was fully assured. He believed Mr. Belton had completed almost a quarter of a century's service with the Company. This in itself was a testimonial, without anything else. When Mr. Belton came to Shrewsbury the make of gas was a little more than 80 million cubic feet; last year it reached about 174 millions; and this year, he believed it would be quite 180 millions. This, in view of the fact that the population had only increased about 5 per cent., showed that it was a keener sense of the commercial requirements of the case that had brought about the success of the Company. Mr. Shadbolt's words were cordially endorsed; and the toast was drunk accompanied by musical honours.

In his acknowledgment, Mr. Belton testified to the sympathetic support given him by his Board. Since he came to Shrewsbury, their work, he said, had been successful and profitable. Mr. Shadbolt had told them that there was the great difference of 100 millions in the consumption of gas between now and the time when he came to Shrewsbury, with only a 5 per cent. increase in the population. Before he (Mr. Belton) was appointed, the use of gas stoves was almost unknown in the town, as his predecessors had not thought it worth while to carry enough pressure in the daytime to encourage people to use gas-stoves. In his valuable "Handbook," Mr. Thomas Newbigging laid down certain golden rules for gas managers; and two of them were: "Keep up the heats of the retorts," and "Keep down the pressure in the mains during the daytime." His (Mr. Belton's) predecessors seemed to have laid well hold of that last rule. The consequence was that he did not think there were 25 stoves in the town when he took office; and the leakage at the time was 7¼ per cent. Some stoves were then bought and advertised; and the Company showed the inhabitants that they would provide them with the necessary gas and an increase in the day pressure. The first year they registered an increase of nearly 7 million cubic feet; and the leakage was decreased to a little under 6 per cent., although the mains carried a greater pressure. They had now over 2000 stoves in use, of which about 1700 were on hire. The result of this was they had now to carry a pressure in the daytime almost equal to that of the night pressure. During the cooking hours, they now gave a pressure of 2 inches; and for twenty years, until five years ago (when the mains were considerably disturbed through sewage operations), the leakage rarely exceeded 5 per cent. The Company suffered much trouble over this disturbance of the streets; and there was an arbitration in regard to it with the Corporation. The leakage went up to about 8½ per cent.; but they had now got it down to about 5¾ per cent. By next year, he hoped to reduce it to 5 per cent. again; and with somewhere about 6000 consumers and 40 miles of mains, this, he thought, was a reasonable figure. In his concluding remarks, he expressed his gratitude to Messrs. R. Dempster and Sons for the exceedingly liberal interpretation they had given to his plans, and their careful consideration of all his ideas. The agreement they had been able to maintain throughout the work respecting the various points that had arisen, was largely due to the Contractors. They had between them striven to produce an up-to-date plant, without incurring an unnecessarily large capital expenditure; and although they had not adopted so many labour-saving appliances as existed on some works, they had adopted everything that would give a fair return in £ s. d. He was pretty well convinced that he should do the whole of the work connected with the manufacture of gas in these works at from 1s. to 1s. 1d. per ton of coal. At the present time in the old works, it was costing 2s. 9d. for hand work. He need not say what the difference would represent on a year's working.

Mr. T. Berridge proposed "The Health of Messrs. R. Dempster and Sons," coupling with the toast the name of Mr. Broadhead, about whom he said some kind and complimentary things. In his reply, Mr. Broadhead mentioned that, although the work had been done expeditiously, it would have been completed much earlier except for the unusually wet twelve months in which the work had to be done; also that the whole of the work had, with only a few minor exceptions, been done (without any sub-contracting) by the firm's own workmen. He reciprocated the compliment paid to his firm by the Engineer, by thanking Mr. Belton for the way in which he also had interpreted the contract; and he further thanked the Clerk of the Works for the Company (Mr. W. L. Robertshaw), Mr. Belton's assistants (Mr. Elliott and Mr. Woodford), and the firm's own representative (Mr. W. L. Heald).

Suction Gas Plants.—In condensing the remarks made by Mr. J. Chamberlain, of Catford, in the discussion on the subject of gas-engines, at the meeting of the Junior Institution of Engineers, the omission of a few words caused a misapplication of the final sentence. He did not state that the suction gas plant "could be fitted to engines of over 100-horse power by utilizing the energy of the exhaust for generating steam." This portion of his statements referred to a patent tubular boiler for utilizing the heat of the exhaust for raising steam up to 160 lbs., and which is applicable to engines of 100-horse power and upwards. The suction gas plant that he referred to is that of Pintsch, of Berlin, which, he says, works "with as low an economy as ½d. per brake horse power per hour, at which cost coal gas even at 2s. 6d. per 1000 cubic feet costs more than twice as much. Plants from 4 to 2000 brake horse power are working on this principle with anthracite, coke, and coal." In concluding his communication, Mr. Chamberlain says: "The gas-power installations at Millwall referred to by Mr. S. Cutler, jun., are also nearly all driven by power gas made at the factories themselves; and the further development of power gas has recently taken the form of a portable suction gas plant and engine which rivals the oil-engine for easy transport and economical working." Regarding the statement as to Mr. Cutler's remarks, it will be seen that that gentleman did not state that the whole of the works to which he referred as using gas-engines at Millwall employed coal gas, though the context might possibly lead one to suppose that that was so. He distinctly put it that "one reason" for the popularity of gas power in the district of the Commercial Gas Company was the discount that the Company allowed for gas used for motive purposes. At the same time, we know the Commercial Company can show that a very substantial business has accrued from their policy in this respect; and whether a majority or a minority of the thirteen works alluded to use coal gas or producer gas is really a small matter.

TECHNICAL RECORD.

THE DISCUSSION ON MR. GLASGOW'S AMERICAN ASSOCIATION PAPER.

[See Also, p. 671.]

Since the article appearing elsewhere to-day—headed "Criticisms of Mr. A. G. Glasgow's 'Policy of Gas Enrichment' Paper"—was in type, the number of our American contemporary, "Progressive Age" for the 1st inst., has come to hand. It contains a summarized report of the remarks made by the various speakers in the discussion that followed the reading of the paper; and it is reproduced below—not omitting the condensed account given of Mr. West's remarks, though these are in part covered by the fuller abstract appearing elsewhere.

The PRESIDENT called for a free discussion, and

Mr. DOHERTY took the floor to say that the paper implied a severe arraignment of many men who were not there to defend themselves. He thought that a spirit of American fairness should guide them in their discussions. He was in sympathy with the author on the question of low-candle power gas, but did not agree with all he said.

Mr. J. ARNOLD NORCROSS took exception to the sentence which declared that "it is scarcely necessary to refer to the foolish attempts to dilute coal gas by the admixture of blue (or lightly carburetted) water gas." He thought it could not be so readily dismissed, as there was a certain tendency evident in America based on European authority of the highest character. He thought a careful reading of the paper and the author's contributions to the "JOURNAL OF GAS LIGHTING" would induce anyone to agree with Mr. Glasgow. In Germany the movement towards using blue water gas with benzol enrichment originated in the high price of oil—due to import duties of over 100 per cent. upon it—and the relatively high price of English coal. German coal gives a low yield of low candle-power gas and poor coke. Carburetted water gas could not be made with profit, therefore; and as benzol was a native product and cheap, it was utilized. The candle power of gas in German towns is very seldom over 13·5 English candles, and more often 10 and 11 candles—a condition which is far from existing here. About 1901, the price of English coal increased so as to make it difficult for gas companies in Germany to keep up manufacture; and the German Gas and Water Association (among them Dr. Bunte) petitioned the Government to relieve the condition by reducing the import tax on oil. In England, the movement toward low candle-power gas was due largely to Professor Lewes, who visited Germany and became enthusiastic over the blue water gas made there, and wrote a few papers—among which was one read before the Glasgow Exhibition Congress in 1901, dealing with the passing of blue water gas through coal-gas retorts in order to prevent the illuminating hydrocarbons from being broken up, and later another lecture before the Society of Arts. He claimed by this process an increase of 20 per cent. in heating value and candle power also. Mr. Norcross said that "it seemed marvellous that, by merely admitting blue gas into a retort, you could get 20 per cent. gain in heating and lighting power as compared with a simple mixture of the two gases after manufacture. In the first experiment, he added 29·5 volumes of blue gas, of a net heating value of 73·4 calories per cubic foot, to 70·5 volumes of coal gas of 138·8 calories per cubic foot. By direct arithmetical calculation, the resultant mixture would have a net heating value of 119 calories per cubic foot. Professor Lewes stated, both in tabulating the experiment and later on, that there was a gain of 20 per cent. Turning, however, to the end of the experiment, it will be seen that the heating value of the mixture actually observed by Professor Lewes by the calorimeter was 117 calories. There is, therefore, no gain whatsoever in calorific power; but, on the contrary, there was a loss as compared with simple mixing." As there was no gain in heating power, no appreciable amount of rich vapours could have been carried along, and there probably was no gain in lighting power. By varying the method of testing, Professor Lewes showed that he could get a gain of 22 per cent. in candle power.

Mr. ROLLIN NORRIS thought that any company supplying water gas can reduce the cost of manufacture by reducing its enrichment. The price of gas to the consumer, however, cannot be reduced unless the change to lower candle power is accompanied by a change in process reducing the cost of manufacture considerably. If the consumer got all the saving due to reducing enrichment, it would amount to but two-thirds of a cent. per candle power reduced. If the candle power were 5 candles less, there would be a reduction in the cost of making of 3·33 cents. If, however, there were another process that could make gas for about 25 cents less per 1000 cubic feet, it would be a strong argument in favour of its adoption. "In general, the higher the candle power of the gas supplied, the more the consumer gets for his money if he pays the entire extra cost of the increased candle power."

Mr. ROBERT YOUNG said that it was much easier to obtain complete combustion with gas of low candle power or low calorific power. It is difficult to provide enough oxygen to completely burn rich gases. Otherwise, the arguments are in favour of high candle-power gas. A less rich gas will also require larger mains, services, meters, and fittings.

Mr. LITTLEHALES said that he had closely followed Professor Lewes's experiments, made at the Crystal Palace Gas-Works. The addition of 40 per cent. of blue water gas increased the volume to that extent while reducing the candle power but 1·5 candles. He thought the claim could be pretty well established that blue water gas becomes carburetted while passing through the retort and hydraulic main, and takes up light hydrocarbons that otherwise would go into the tar.

Mr. JOHN WEST (of Manchester, England) said that he wished to disagree with Mr. Glasgow. He did not wish to be understood as antagonistic to carburetted water gas, but belonged to the "low-grade" party to the discussion now going on in England. The kind of gas to be used depends upon conditions. As to cannel enrichment being played out, he would say that large quantities of cannel coal are still used. Years ago, when the candle-power standard was increased, the demand for cannel coal sent up the price, so that many were glad when carburetted water-gas enrichment came in and adopted it from necessity. The vapour enrichment experiments of the South Metropolitan Company showed that it did not carry very far. The parliamentary requirements were for 16-candle power gas; but the Chief Chemist of the Gas Examiners reported 14·68 candles as found upon the portable bar photometer, which might indicate that the Company was not living up to requirements. In London, the gas supply is regulated by the Metropolitan Board of Works, who appoint three Gas Referees. The latter arrange the official testing, locate and fit up testing-stations, very seldom at the works, and often several miles away. Some of the South Metropolitan districts have stations nearly four miles away from the gas-works. Gas is tested daily in all sections of London by a large number of officials who are watching for laxity in enrichment; the Gas Companies being fined for each case of candle power found below that required. These official testers say that the gas in the South Metropolitan Company's area is 16·58-candle power. The gas tested 16·77 candles at the works for the half year ending June, 1901. Dr. Clowes had tested gas at unfair places—such as disused pipes, dead-ends of mains, &c., and naturally found a lower candle power. Mr. Glasgow had been misled by Dr. Clowes's statement. He disagreed on the question of capital expenditure and space occupied—saying that they are increasing capacity by increasing the number of retorts per bench—in one case from 3 to 10, greatly increasing the output. As to coke, in some places it is much in demand; in others not at all. In one works they recently dug up roads made of coke breeze to get coke, which was washed and sold by reason of the great demand. He did not agree with the position with regard to machine work, and did not think that the noxious products from coal gas were any worse than from carburetted water gas. He hoped manufacturers were not making stoves without flues for carrying off combustion products. Fifty years ago, Thomas Sharpe advised against flueless stoves; and he would advise all not to fix a stove without a flue. He questioned the integrity of the 14-candle gas used by Mr. Glasgow in his tests, and wanted to know whether it was 16-candle power gas reduced to 14-candle power by calculation or otherwise. He knew of no 14-candle power gas consisting of one-third carburetted water gas and two-thirds coal gas; and as all the results were based upon it, if there was any reason why this low candle power gas was not representative, the conclusions of the argument cannot be sustained by reason of false foundation. With the Welsbach burner, his own tests did not show much difference in candle power when using 15 and 20 candle power gas. Although the Gaslight and Coke Company gas is taken at 75 cents, Livesey is supplying gas at 55 cents per 1000. He did not think anyone would be bothered with naphthalene if they made their gas properly, especially with thorough condensing and washing. He had been the first to test the Welsbach with low and high candle power gas, although Dr. Macadam soon afterwards tested a similar burner with 12-candle and 28-candle gas—noting the advantage to the public of the former, and recommending Edinburgh to reduce its candle power. At the recent stockholders' meeting, Sir George Livesey said they had not sold any more gas since lowering the candle power than could be traced to natural increase—showing that not more of the low candle power gas was needed than before. New burners were given to consumers, however; and with their 14-candle straight coal gas they get better light than those who use gas supplied by the other Companies. Mr. West thought that consumers should use the best burners they can get. The calorific power of the South Metropolitan 16-candle power gas was 645 B.T.U. per cubic foot; and he thought there was no doubt but that Sir George Livesey was now supplying a 600 B.T.U. gas, as he had made it himself with the same coal. They formerly made 14·5-candle gas from Newcastle and Durham coal, but had to raise the candle power. Now they have convinced Parliament that the lower grade gas was better, and do not enrich at Stroud and Maidstone. At Plymouth, they charge 50 cents per 1000 for gas. He recommended high heats in the retort by which 1000 cubic feet more gas per long ton of coal could be obtained. "The higher the temperature the greater the permanency and calorific value obtained.

The question is how many units you get out of a ton of coal with quick heats and working good charges, and you will get a large volume of permanent gas of high calorific value." He advises using good coal and getting a good gas.

Mr. WALTON CLARK was sorry to have Mr. West think that the author criticized English gas men; for it was his impression that Mr. Glasgow was fighting the tendency to lower the candle-power standard of gas. He also failed to support Mr. West in his reference to the author's attitude towards the portable testing photometer and the South Metropolitan Company living up to parliamentary requirements, for the paper itself indicated neither.

Mr. ALEX. C. HUMPHREYS (who was answering the discussion for the author) said that Mr. Doherty's view upon not discussing English practice because it involved the work of English gas engineers who were not present to defend themselves if necessary, was not compatible with the best work of technical societies. Mr. Glasgow had taken the precaution to offer to submit the manuscript of his paper to Sir George Livesey, to give him an opportunity to discuss it if he so desired; but the latter did not care to do so. English parties to the previous discussions upon this topic attempted to discuss a subject which they did not fully understand. They did not sufficiently study the letters they attempted to answer; and he advised Mr. West to study this paper more thoroughly. Just as Rankine frequently omits intermediate steps in the argument, Mr. Glasgow does likewise; and those of us less gifted mentally have to supply the steps to follow the demonstration. Mr. West had read the paper incorrectly, and received impressions that the author had not conveyed. The special tests, for example, were made to see how well the South Metropolitan gas would carry the enrichment. Sir George Livesey admitted that those of nominal 16-candle power and nominal 14-candle power gas were fair for purposes of comparison. Mr. Glasgow stated that 16-candle power gas was to be found at the testing-stations, and that requirement was met. He referred to Mr. Glasgow's paper read at the New York meeting as also worthy of study. Across the river from New York is a water-gas plant with a daily capacity of 30 million cubic feet and 10 million storage capacity—all on six acres of ground. As to the lack of coke piles now in England, that is readily explained by the advent of water-gas apparatus, which now occupy the space they took up. Even if Mr. West's mechanical stoker brought the labour costs below the comparative figures stated by the author, the latter's figures on economical advantage in selling gas of higher candle power are based, not on this comparison, but on costs of manufacture taken from the published accounts of London Companies. He thought we could make it worth while for Mr. West to show us how to make straight coal gas that would not deposit naphthalene. If Mr. West could get more gas of a higher calorific value by using higher heats, there would be a great future for him in this country. Mr. West's arguments are based on misconceptions also in regard to the two gases tested by Mr. Glasgow. The Gaslight and Coke Company was supplying 16-candle power gas, and the Parliamentary Committee thought they also should reduce the standard to 14-candle power, which was resisted; and Mr. Glasgow was engaged in showing the inadvisability of so doing. He, therefore, compared 16-candle power mixed gas with 14-candle power mixed gas, as the Company was facing a compulsory reduction of 2 candles in its mixed coal gas and water gas. Mr. West may fail to see the point with reference to the Bunte diagrams of Dessau tests, and the point may still be there. He and Mr. Glasgow would be delighted to have Mr. West go home and prepare a reply.

Mr. WEST replied that he did not accept Mr. Glasgow's conclusions, and wished he would take into consideration the 1000 extra cubic feet of gas they make at the Gaslight and Coke Company's plant. If he had made any errors, he was ready to rectify them.

Mr. JAMES SOMERVILLE thought it a pity that such a fine paper should have a controversial discussion only. The subject is more deserving. He thought that candle power was a misnomer, and that the point of the paper was that we are purveyors of energy. He did not see, therefore, how a 500 B.T.U. gas could do as much working as a 650 B.T.U. gas when burned in the same way.

In the leader columns of "Progressive Age," the following article appears, entitled "Discussion or Controversy."

In consideration of the low candle-power gas distributed in Europe, the various plans for supplying uncarburetted water gas and producer gas, and the amount of interest manifested in the matter, we rather expected a more exhaustive discussion upon Mr. Glasgow's paper. Instead, we find mixed in with some relevant remarks a controversy, the gist of which is a eulogy on Mr. Glasgow on the one hand, a general denial of his statements on the other, and the gas industry is the richer by little more than the paper itself, which should more properly have been entitled the advantages of carburetted water gas from the affirmative point of view.

We do not wish to discuss here the subject-matter of the paper, nor to view it in a critical spirit; but we would like to point out the danger which lies in getting an author to write a paper upon a subject in which he is other than technically interested, expecting him to treat it from an unprejudiced standpoint, and expecting to avoid the generation of more or less heat in the controversy which usually follows. It were better that the author should not be commercially connected with his subject for the sake of freedom in discussion. If a commercial paper is considered of value to the industry, let it be descriptive, and not controversial. It may be that Mr. Glasgow's style in writing is unnecessarily aggressive. He seems to end with a "*Q.E.D.*, now what can you say to that?" which invites replies in the spirit of debate rather than the simple presentation of fact or well-grounded opinion. That has been the effect on the controversy in the English journals, and is one of the influences that, no doubt, prevented discussion of the paper along lines the members of the American Association would have preferred. These are a few factors to consider in the future selection of papers.

The discussion on the paper was distinctly disappointing with one or two exceptions. In a country where probably three-fourths of the gas made is carburetted water gas, it seems hardly necessary to enter into a defence of the process. Extent of enrichment is a subject of unusual interest, and is well worth working up, from a disinterested standpoint, for one of our Gas Associations. A series of curves, showing the influence of fixed charges, light or heat value, prices of coal and oil and other variables upon the price of gas, and a discussion of them to show how the ratio between price and enrichment shall be established, would be of great value in crystallizing opinion into definite conviction. The discussion upon it should be technical rather than personal. One does not care to be told to go home and study the paper before discussing the work of so talented an author, and that he may have to work out the elementary steps in order to follow the Rankine-like argument. One does not like to see discussion thus discouraged. Facts are not confined to gifted sources; and every member should have an equal right upon the floor of the meeting room if he has a message to impart. It were strange indeed if the information relating to water gas were confined to one brain. Let us be generous to our fellows, even if they are not so well informed as opportunity may have made us. Above all things, let us avoid a controversial spirit in discussing Gas Association papers.

Mr. Frederic Egner, of Washington, sends for publication the following comments on Mr. Glasgow's paper.

I confess to considerable disappointment on finding that this somewhat pretentious paper seems to be nothing but an attack, at long range, on the policy of Sir George Livesey, who, like that accomplished, brilliant, and justly famous (in his time) Gas Engineer, General Charles Roome, dared to proclaim and maintain that the manufacture of illuminating gas of extremely high candle power was a costly mistake for producer and consumer alike. The great improvement in artificial lighting, the Welsbach incandescent gas-burner, had not been perfected in General Roome's day, when that gentleman expressed his adverse convictions concerning very high candle power gas, which was then made only possible by the introdution of carburetted water gas, while now Sir George Livesey, recognizing the value of this great improvement in the application of gas, proposed and put into effect methods by means of which consumer and producer could take advantage and derive the benefits of modern progress.

Mr. Glasgow, being in the carburetted water-gas business, and apparently not fancying what he seems to have regarded as detrimental to these interests, has stated his views at great length in his admirably-put-together paper. But he seems to entirely ignore the fact that there is no longer the one-time, perhaps, desirability of very high candle power gas, since, when employing the Welsbach mantle, the gas—no matter what its initial candle power may be—must be reduced to a non-luminous condition before it can be successfully used in the mantle burner. That the Welsbach light is the most economical source of artificial light admits of no argument—since denying this, would be simply ignorance. Then, why put an expensive illuminant into gas, which will be better for the purpose without it? One might as well deny the superiority of the electric trolley street-car over the old horse car, or try to hold up the introduction of the former because some people might decline to use it, as to continue to use a no longer necessary high priced enricher, because there are people who will stick to the old style of gas-burner.

Mr. Glasgow is always an interesting, and generally an instructive writer; but when he uses his great talents to boost a policy which has been outstripped by the march of improvement, it is time to halt and to question his disinterestedness. That he is not forgetful to keep his end well up, is seen in his statement of the "Approximate Independence of Labour," where the ratio is given as follows: Carburetted water gas, 1; coal gas—inclined retorts, 3·5; machine work, 4; handwork, 6 to 7. It was well that Mr. Glasgow "hedged" a bit by basing his figures "on a scale of large operations," because on almost any other scale, the results would not always be so flattering to water gas—as, for instance, with inclined retorts the ratio would in many cases be more like 1 to 1, than 1 to 3·5.

And so it does seem to the writer that the whole of the paper—though read for and at the thirty-first annual meeting of the American Gaslight Association—was nothing but a shot, at long range, at certain common-sense British Acts, but with which Mr. Arthur Graham Glasgow is not very well pleased. Advocating the manufacture of gas of a candle power higher than can be conveniently produced by fairly good gas coals is now, in the light of modern improvements in artificial lighting, an inexcusable retrogressive step.

NOTES ON GASEOUS FIRING.

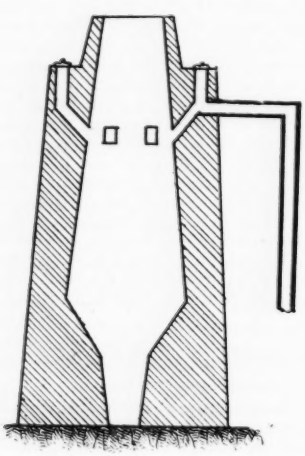
By J. F. Smith, of Halifax.

[A Paper read before the Yorkshire Junior Gas Association, Dec. 12.]

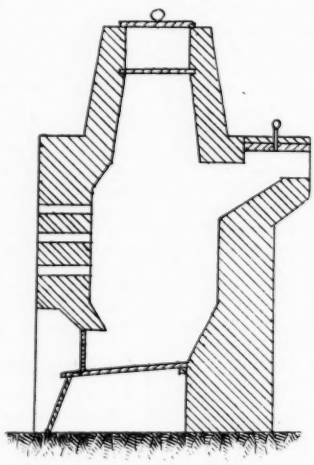
Historical Summary.

Gaseous fuel was first proposed by Lampadius in 1801; but it was not until thirty years afterwards that he brought his proposal into practice.

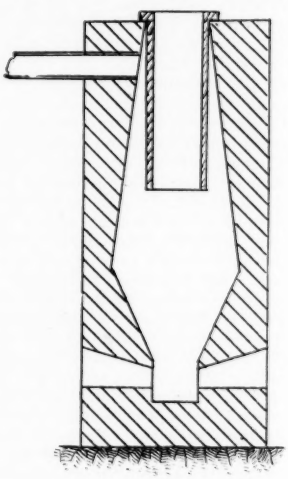
Aubertot, in 1812, was granted a patent for the application to metallurgical purposes of the combustible gases escaping from an iron-furnace; and in the year 1830, attempts were made at the lead works at Halsbrücke, near Freiberg, to employ the flame of coal gas in cupelling the silver lead. But neither of these attempts at introducing gaseous combustibles as fuel was followed up until the subject was carefully investigated by Faber in 1837, at an iron-works in Würtemberg, the results of which led to the general adoption of the waste gases from iron furnaces as fuel, and the production of gas specially for the purpose.



Faber's Furnace.



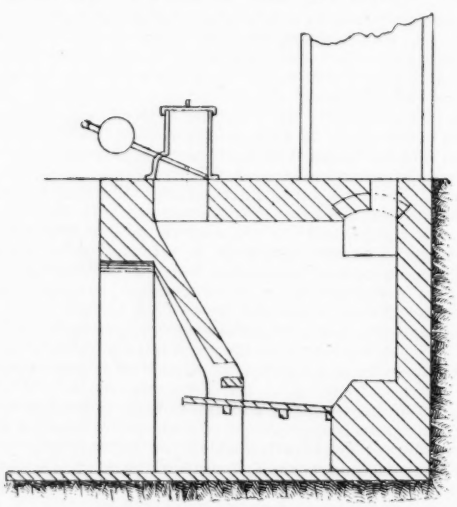
Bischof's Generator.



Ebelmen's Furnace.

For conducting the waste gases from the iron-furnace, Faber made in the side of the furnace several apertures which were connected to a flue, leading from which was an iron pipe for conveying the gas to the place of consumption. The flow of gas was regulated by a damper fixed into the pipe.

Bischof designed a generator without blast that was used at Mägdesprung, in the Hartz. The central part or body of the furnace was cylindrical, and was about 5 feet in diameter and



The Siemens' Generator.

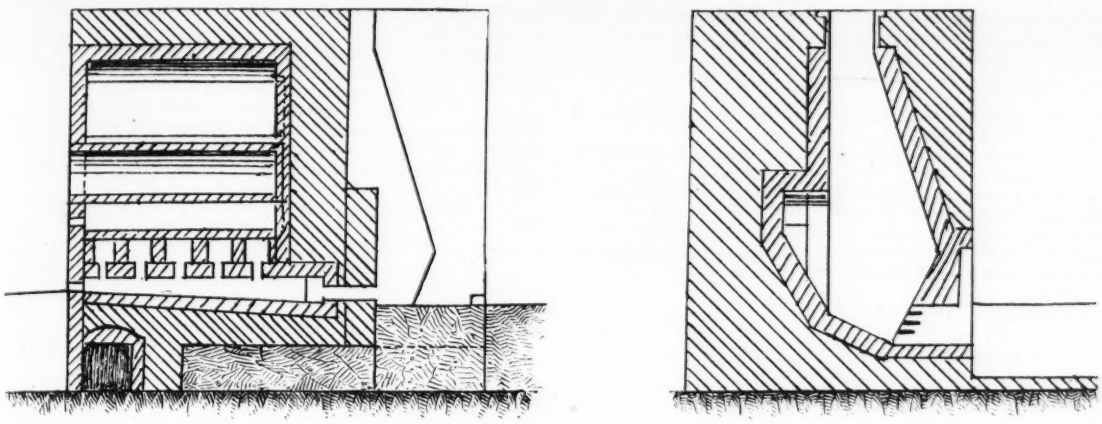
5½ feet high. The upper and lower parts were conical; the upper being about 4½ feet and the lower about 2 feet high. At the bottom of this was a conical grate, below which was an ash-pit that could be closed by an iron plate. The door of the furnace could be closed by a sheet of iron. The gases escaped from the upper part of the furnace, which was covered by sheets of iron and sand, so as to retain as much heat as possible. In this flue was fixed a damper for controlling the escape of the gases. The throat of the furnace was separated from the body by means of an iron damper. The space above this was sufficiently large to hold a charge of the solid combustible matter with which the generator was supplied at intervals; and by withdrawing the damper this could be dropped into the furnace without opening the top lid. The air was supplied to the generator through three apertures (2 inches in diameter) in the iron-plate cover of the ash-pit. The production of gas was controlled by means of the damper and these three apertures. The progress of combustion could be watched through three square apertures or sight-holes in the side of the furnace, which could be closed by means of bricks.

About 1841, Ebelmen designed and erected a generator at Audincourt, which was intended to be worked with a blast of air. This furnace was slightly different in shape from any of the previous ones. In its proportions, it resembled a small iron-furnace —being about 10 feet high; the widest parts being about 3 ft. 6 in., the narrowest part (which was above the hearth) being only about 10 inches, and the throat of the furnace about 13 inches in diameter A cast-iron pipe was placed down into the furnace, so that the end would project about 4½ feet into the body of the furnace. This pipe was kept constantly filled with the fuel. A lid was only necessary when the fuel was large, as the small fuel was sufficient to prevent the free passage of the gas from the furnace. Round the pipe the gases could collect, and then pass along a pipe fixed into the side and near the top of the furnace, to the place where they were required. A much more abundant supply of gases could be got from this furnace than from any of the others. The blast used was considerable, so that the gases could be used below the level of the furnace. It was a drawback in the previous constructions, that the hearths where the gases were to be consumed had to be on a level with the exit tube of the furnace; so that in many cases the generator had to be sunk below the surface of the ground.

Regenerators were first used by Dr. Stirling, of Dundee, in 1817, in connection with an air-engine which he patented in that year. The regenerator consisted of strips of glass or metal, brought closely together. The principle of its action was first a lowering of the heat of a fluid by giving up its heat to the regenerator.

The first application of regenerators to furnaces was made in 1856 by Frederic Siemens. In this arrangement, solid fuel was used, which was burnt intermittently on two separate hearths—having a furnace in the centre of them, the air passing between. The air in the furnace passed first through the regenerator, and then to the burning fuel. The waste products of combustion, after heating the furnace, gave up their remaining heat to the second regenerator, and then passed to the chimney. The current was reversed by means of valves specially constructed for the purpose; and the air was made to pass in the opposite direction —the second fireplace being at the same time supplied with fuel.

During the following year, improvements were made to this furnace; the chief being a plan of heating a single chamber continuously by means of one fireplace, in combination with the alternate reversals of the currents through the regenerators, without reversing the direction of the flame. In this patent, there seems to be the first idea of a separate producer and regenerator. This was developed by Sir William Siemens, who brought out in 1861 a regenerative gas-furnace with a separate producer and a gas and air regenerator which is now used in metallurgy. A special application of this furnace was introduced in 1866 for melting steel in pots; and in 1868, horizontal regenerators were employed. The gas regenerator was uppermost; and a small chamber for air and gas, which prevented combustion therein, directed the flame in a jet through a tapering aperture across the bed. This arrangement also afforded facilities for the cleaning out of the flues; for which purpose manholes were placed in the regenerators. The application of the gas-furnace



FICHET'S SETTING AND GENERATOR.

to annealing furnaces and steam-boilers, was also described by him at this time.

In 1870, a new form of producer was made by him, which was introduced into the glass industry—one of the first industries, outside metallurgy, to take up regenerator furnaces.

The gas-producers first introduced into gas-works for heating retorts were outside generators, some with the reversing valves and some without. The only one of these that will be referred to was built in 1873 by Messrs. Muller and Co., and experimented with by M. Fichet at the Montreuil Gas-Works. This setting had the gas-producer built at the back, and was of the open-grate pattern. The producer made the gases for two beds of seven retorts. The air was admitted in front, under the retorts, after it had been made to pass through channels in the brickwork. The proportions of the gas and air were regulated by means of dampers; and the temperature of the furnace was regulated by means of the chimney-damper. The results obtained with this were equal to the coke produced by 17½ lbs. of coal per 100 lbs. of coal carbonized, against 30 to 35 per cent. in the direct-fired setting at those works.

One of the first, if not the first, setting with inside generator and regenerators that worked successfully, was at the Denton New Gas-Works (Cheshire), in 1883. Before this, the generators or producers were outside.

The regenerator furnace is now so well known that it will not be necessary to describe the many settings that have been brought forward by both English and Continental engineers, and which are known by their names.

THERMAL CHEMISTRY.

The principle of gaseous firing is based upon the well-known reaction that, when a solid fuel is burnt with insufficient oxygen or air, a combustible gas is formed, which is represented (in the case of carbon) by the formula: $C + O = CO$. This gas can be burnt to carbonic acid in the required place by the combination with a further supply of air—thus: $CO + O = CO_2$.

The theory of the formation of the producer gas is that the incandescent carbon in the presence of air is first converted into carbonic acid, and that this gas, on passing through a further portion of the incandescent carbon, is converted, by taking up a further atom of carbon, into carbonic oxide, which may be represented as follows: $CO_2 + C = 2CO$. This theory is supported by analyses of samples of gases taken from different depths of the fuel beds. The following results, taken from Ebelmen's analyses, show this very clearly:—

	Height above Air-Inlet.		
Constituent	8 inches	1 foot	2 feet
Carbonic acid . . .	8·11 ..	5·87 ..	0·16

It is evident from these figures that the production of carbonic acid is done in a very thin layer of the fuel, and is probably a surface reaction. The equations usually given in text-books for the calculation of the heating value of fuels are not accurate; so that the values obtained by their use vary very considerably from those obtained by direct experiment. The sources of error are chiefly as follows:—

1. Uncertainty of the heating power of carbon when in combination, since the different varieties of the element give different figures.
2. The heating power of hydrogen is determined for the free gas. In solid fuels, the hydrogen is not gaseous, but solid; and in that condition its heating value must be different.
3. Compound bodies never give the same amount of heat on combustion as the elements of which they are composed would do in a free state; the amount of heat evolved by the combustion of the compound being usually less (though sometimes it is more) than that given by the free elements, according as the compound itself was formed with the evolution or absorption of heat.
4. Sulphur is not in a free state as given in the equations, but is in combination as sulphide and sulphate, and would require different amounts of heat to be added to them before the sulphur would be liberated for combustion.
5. The ash is not taken into the calculation, though there are always thermal reactions occurring in it during the burning of the fuel, or in the production of a combustible gas.

It will be seen that it is anything but a simple matter to calculate the heating power of a solid fuel, such as coke; for this requires not only a very complete analysis, but a complete knowledge of the state of combination in which the substances exist in that fuel.

These facts stand in the way of a complete understanding of all the changes that go on in a gas-producer; so that, in order to get a general idea, it is best to suppose that we are dealing with pure carbon. It has already been stated that gaseous firing depends on the production of carbonic oxide in the furnace and afterwards burning this with the proper proportion of air. In the formation of the carbonic oxide there will be evolved 4350 B.T.U. for every pound of carbon burnt to this compound; so that, if we take our formula as representing pounds of the substances represented in that equation, we should get—

$$\begin{array}{l} C + O = CO \\ 12 + 16 = 28 \end{array}$$

in which there would be 12×4350 B.T.U. = 52,200 B.T.U. given out in the formation of 28 lbs. of carbonic oxide; or, taking the theory that carbonic acid is first formed and then reduced to carbonic oxide, the reactions would be—

$$\begin{array}{l} C + O_2 = CO_2 \\ 12 + 32 = 44 \end{array}$$

n which the heat units would be $12 \times 14{,}500 = 174{,}000$ B.T.U., which is the heat of formation of 44 lbs. of carbonic acid, which on reduction to carbonic oxide would be—

$$\begin{array}{lll} CO_2 + C & = & 2CO \\ 44 + 12 & = & 56 \\ 174{,}000 \text{ B.T.U.} & 104{,}400 \text{ B.T.U.} & = -69{,}600 \text{ B.T.U.} \end{array}$$

So that in the reduction of 44 lbs. of carbonic acid to 28 lbs. of carbonic oxide and the formation of another 28 lbs. of carbonic oxide, there has been 69,600 B.T.U. absorbed.

When 1 lb. of carbonic oxide is burnt to carbonic acid 4370 B.T.U. are evolved; so that, following out our reactions, we get—

$CO + O = CO_2$
$28 + 16 = 44$ lbs. formed, evolving $28 \times 4370 = 122{,}360$ B.T.U.

These show that $\frac{52{,}200 \times 100}{174{,}560} = 29{\cdot}96$ per cent. of the heat is given off in the production of the furnace gas.

Under the conditions of firing as now practised in most gas-works, the greater portion of this heat is carried into the combustion chamber by the gases, and performs a certain amount of work; so that there is very little difference between the heat of combustion of the fuel in this way, and that which should be given out by burning the carbon directly to carbonic acid, supposing the air was just sufficient in both cases to consume it.

In the case of gaseous firing, it is possible to regulate the supply to almost the theoretical quantity, and get to perfect combustion; whereas with solid fuel burnt directly to carbonic acid, at least one-and-a-half times to twice the theoretical quantity is required to effect this; so that it is in this way possible to get a much higher temperature by these means than with the old direct-fired system.

If steam and air are used in the production of the gas, the result produced in the generator is different; for when steam is blown over highly-heated carbon, the following reaction takes place:—

$$\begin{array}{l} H_2O + C = CO + H_2 \\ 18 + 12 = 28 + 2 \end{array}$$

The formula shows that 18 parts of water vapour are decomposed

by the heated carbon, forming 28 parts of carbonic oxide and 2 parts of hydrogen; or, if this is represented by volume—

$$\begin{array}{ccccc} H_2O & + & C & = & CO & + & H_2 \\ 2 \text{ vols.} & & & = 2 \text{ vols.} & & & 2 \text{ vols.} \end{array}$$

which shows that the resulting gas contains equal volumes of carbonic oxide and hydrogen.

Water vapour is a very stable compound, and in its formation much more heat is evolved than in the formation of carbonic acid; so that when it is decomposed by means of the incandescent carbon, this amount of heat, less that given out by the formation of the carbonic oxide, will have to be supplied to it. This can readily be seen by writing the formula and putting the thermal units under the equation, as was done in the foregoing ones. Thus—

$$\begin{array}{ccccc} H_2O & + & C & = & CO + H_2 \\ 2 \times 61{,}500 & & & & 12 \times 4350 \\ 123{,}000 \text{ B.T.U.} & & & & 52{,}200 \end{array} = -70{,}800 \text{ B.T.U.}$$

which show that the heat is rapidly absorbed and in large amount; so that the coke would rapidly cool elow the point at which the reaction would be possible.

But when steam and air are sent through the heated carbon in certain proportions, so that the heat evolved by the action of air on the fuel is largely in excess of that required for the decomposition of the steam, it becomes possible to obtain a continuous supply of the gases. In practice, four or five times as much carbon is consumed by air as by steam. Assuming this to be five times, the following will show the reactions—

$$H_2O + C = CO + H_2.$$

Heat evolved 123,000 B.T.U. 52,200 B.T.U. $= -70{,}800$ B.T.U.

This shows that 12 lbs. of carbon have been consumed by the steam; so that the carbon required by the air would be $12 \times 5 = 60$ lbs., which would be represented by the equation, thus—

$$\begin{array}{l} 5\,C + 5\,O = 5\,CO. \\ 5 \times 12 + 5 \times 16 = 5 \times 28 \\ 60 + 80 = 140 \text{ lbs. produced;} \end{array}$$

and the heat evolved would be 60×4350 B.T.U. $= 261{,}000$ B.T.U. Taking from this the 70,800 B.T.U. absorbed by the steam, it will be seen that the quantity of heat given off in the producer is 190,200 B.T.U., while producing 2 lbs. of hydrogen gas, and 168 lbs. of carbonic oxide, from 18 lbs. of steam, 72 lbs. of carbon, and 80 lbs. of oxygen from air.

The composition of the gases already considered would be as follows:—

Carbon and Air.		*Carbon, Air, and Steam.*	
CO . .	34·3 per cent. by weight.	CO . .	38·37 per cent. by weight.
N . .	65·7 ,, ,,	H . .	0·46 ,, ,,
		N . .	61·17 ,, ,,

From these, it will be seen that the gas produced by steam and air is richer in combustible gases than the one produced by air alone, though less heat has been generated in the producer in the formation of it. This is shown by the following calculations of the heat of formation from these percentages:—

Carbon and Air.

$$\text{Carbonic oxide} = 34{\cdot}3 \times \frac{12}{28} \times 4350 = 64{,}945 \text{ B.T.U.}$$

Carbon, Air, and Steam.

$$\begin{array}{lll} \text{Carbonic oxide} = 38{\cdot}37 \times \frac{12}{28} \times 4350 \ldots & = & 71{,}521 \text{ B.T.U.} \\ \text{Less hydrogen} = 0{\cdot}46 \times 61{,}500 \ldots & = & -28{,}290 \text{ ,,} \\ & & 43{,}231 \text{ B.T.U.} \end{array}$$

which shows that $64{,}945 - 43{,}231 = 21{,}714$ B.T.U. less are evolved by the use of steam than without, in the production of 100 lbs. of the gases, which means a saving in the brickwork of the generator.

The calorific value of these gases is different, which is shown as follows:—

Carbon and Air.

$$\begin{array}{lll} \text{Carbonic oxide} = 34{\cdot}3 \times 4370 \ldots & = & 149{,}891 \text{ B.T.U.} \\ \text{Nitrogen} \ldots = 65{\cdot}7 \ldots & & \text{..} \\ & & 149{,}891 \text{ B.T.U.} \end{array}$$

Carbon, Air, and Steam.

$$\begin{array}{lll} \text{Carbonic oxide} = 38{\cdot}37 \times 4370 \ldots & = & 167{,}677 \text{ B.T.U.} \\ \text{Hydrogen} \ldots = 0{\cdot}46 \times 61{,}500 \ldots & = & 28{,}290 \text{ ,,} \\ \text{Nitrogen} \ldots & & \text{..} \\ & & 195{,}967 \text{ B.T.U.} \end{array}$$

From these it will be seen that the gas made with steam and air has a calorific value of 46,076 B.T.U. more than the air-produced gas. The amount of heat evolved in the producer by the use of steam and air is only 18·07 per cent. of the total heat evolved, against 29·96 per cent. with air alone.

Besides the proper regulation of the air, there is a further saving in the heating by waste heat of the primary and secondary air used for the production and combustion of the gases. The chief reason for this is that the products of combustion, and the nitrogen present, have to be heated up by the heat of combustion; so that there is a loss from this source so far as the useful heating effect is concerned, though the same number of thermal units are developed in the combustion of the fuel, whether nitrogen is present or not, though the temperatures produced are very different.

For the recovery of the heat carried out by the waste products of combustion, various kinds of regenerators have been designed; but they have all practically the same principle in view. The saving due to these sources can readily be calculated if the temperature and specific heat of the air are known. Suppose that the primary air was heated to 500° Fahr. above the atmospheric temperature, then the B.T.U. supplied from this would be—

$$500 \times 0{\cdot}2377 = 119 \text{ B.T.U. per pound of air used.}$$

We have seen that 1 lb. of carbon requires 1·33 lbs. of oxygen to combine with it to form 2·33 lbs. of carbonic oxide; and as air contains 23 per cent. by weight of oxygen, there would be required $\frac{1{\cdot}33 \times 100}{23} = 5{\cdot}78$ lbs. of air to produce it. So that $119 \times 5{\cdot}78 = 687{\cdot}8$ B.T.U. would be recovered for every pound of carbon burnt, which would be equal to a saving of $\frac{687{\cdot}8 \times 100}{4350} = 15{\cdot}8$ per cent. of the heat evolved in converting the fuel into carbonic oxide, or 4·7 per cent. of the solid fuel.

The heating of the secondary air still further effects a saving in fuel, which is shown in the following calculation, where it is supposed that the waste gases pass into the waste-gas flue at a temperature of 1750° Fahr., and that the air is heated to this temperature—

$$0{\cdot}2377 \times 1750 = 416 \text{ B.T.U. per pound of air heated.}$$

As 1 lb. of carbonic oxide burning to carbonic acid develops 4370 B.T.U. while combining with 2·48 lbs. of air, the saving would be $416 \times 2{\cdot}48 = 1031$ B.T.U. per pound of carbonic oxide consumed, which is equal to

$$\frac{1031 \times 100}{4370} = 23{\cdot}5 \text{ per cent. of the fuel gas.}$$

Another source of saving is in the use of hot fuel drawn straight from the retorts into the furnace. Supposing that the coke left the retorts at a temperature of 1750° Fahr. above the atmosphere, then there would be added to the furnace—

$$1750 \times 0{\cdot}24 = 420 \text{ B.T.U. per pound of fuel added.}$$

If the fuel was perfectly dry, and at the temperature of the atmosphere, it would have to be heated up by the combustion of carbon to carbonic oxide, to bring it up to the temperature of reaction; so that by adding hot coke to the furnace, there is a saving of fuel equal to the B.T.U. that are held by it, which, in the case just mentioned, would be—

$$\frac{420 \times 100}{4350} = 9{\cdot}7 \text{ per cent. of the heat evolved in the production of carbonic oxide.}$$

If the cold coke or fuel has been slaked with water, it retains some of it (generally about 5 per cent.); which will have to be driven off by the heat generated in the furnace; so that there is a further loss in this case, which would be greater than with cold dry coke. This is shown by the following calculations:—

The heat required to raise 0·05 lb. of water from 60° Fahr. to 212° Fahr. would be $0{\cdot}05 \times 152 = 7{\cdot}6$ B.T.U.; and to convert this into steam, $0{\cdot}05 \times 966 = 48{\cdot}3$ B.T.U. Then to raise this to the temperature of the hot coke added—$0{\cdot}05 \times 0{\cdot}48 \times 1750 = 35$ B.T.U. So that the loss of heat units due to water would be 90·9 B.T.U.; while that required to raise 0·95 lb. of fuel to 1750° Fahr. would be— $0{\cdot}95 \times 1750 \times 0{\cdot}24 = 398{\cdot}5$ B.T.U.

The total loss with slaked as compared with hot coke will be $90{\cdot}9 + 398{\cdot}5 = 489{\cdot}4$ B.T.U. per lb. of fuel, or—

$$\frac{100 \times 489{\cdot}4 \times 100}{95 \times 4350} = 11{\cdot}8 \text{ per cent. of the heat evolved in the producer.}$$

In regenerative settings, the heat carried out by the waste gases is, when working properly, reduced to a minimum. This can be determined if the weight of the products, the specific heats, and the temperature are known. Thus, in the case of the combustion of carbon in air, the products would be per 1 lb. of carbon burnt 3·66 lbs. of carbonic acid, and 8·9 lbs. of nitrogen. If these are passing away from the regenerator at a temperature of 500° Fahr. above that of the atmosphere, the loss will be—

$(3{\cdot}66 \times 0{\cdot}2387 + 8{\cdot}9 \times 0{\cdot}2485) \times 500 = 1542$ B.T.U. per lb. of carbon, or

$$\frac{1542 \times 100}{14{,}500} = 10{\cdot}6 \text{ per cent. of the carbon burnt.}$$

Practical Working.

In starting to work regenerative settings, it is first necessary thoroughly to dry the brickwork. In order to do this, the top sight-hole plug should be removed and the damper closed. A small fire is then put into the furnace. As the brickwork dries, the amount of fire on the bars is gradually increased. During this time the furnace and charging doors are kept slightly open, so as to allow sufficient air to enter the setting for the complete combustion of the fuel. When steam ceases to issue from the top plug-hole, the fire is increased and the dampers are opened wide; the top plug being put into its place, to cause the products of combustion to pass along the flues and carry the moisture away with them. The fire is now increased more quickly than before, until the bottom retorts become red hot, when the setting is ready for gaseous firing. The fires are now cleaned and filled with fuel.

When first putting on the primary and secondary air, it is best to put the secondary on first, and then open the primary slide

about twice the area of the secondary slide. The charging and furnace doors are then closed; and the dampers are pushed back so as to leave them open about ½ inch. As the heating proceeds, the air-slides and dampers are gradually opened until the required temperature is reached.

During this time of increasing the heats, very useful information can be got by observing the way the retorts are heating, which is useful in case of future alterations while the setting is working. In setting the air-slides, even in the early stages of firing, it is best to adjust these as nearly as possible, so that there is only a slight excess of secondary air, in order to avoid local heating in the combustion chamber.

There are several methods in use of setting the air-slides, one of which is to take out the first waste-gas plug, and momentarily shut the secondary-air slide, when a flame of unconsumed gas will be seen in the flue. The secondary-air slide is then gradually opened, until the flame can only just be seen or just disappears. This method is capable of giving very good results if the plug is replaced after each slight opening of the secondary-air slide, and the opening of the air-slide stopped when the flame cannot be seen on suddenly pulling out the plug. In working this way, the damper is allowed to adjust its pull on the setting between each movement—so that a large excess of air is avoided; while if the plug is kept out during the alteration of the air-slide, the action of the damper is partially neutralized, and when the plug is replaced, more air is drawn into the combustion chamber, causing a greater shortening of the flame than was required.

Another method is to try the pull on each of the air-flues by means of a water-gauge with a piece of glass tube attached to it by flexible tubing. The scale of the gauge is divided into 5-100ths of an inch. In using this, the gauge is held level in one hand, or rested on some support. The tube is then placed into the ports, and the difference of vacuum noted. From these differences, the areas required can easily be calculated. With a little practice, the slides can be set in a few minutes with sufficient accuracy that the excess of oxygen in the waste gases will amount to about 2 per cent.

The best method is, of course, by analysis of the waste gases themselves; but samples of these should be taken at the point at which the gases first enter the waste-gas flue, for if the regenerators are "short-circuiting," or passing secondary air through the joints in the brickwork into the waste-gas flues, and the sample is taken just above the damper, the results will be very misleading, as any unburnt gas passing from the combustion chamber into the waste-gas flues would be burnt as it passed along these on coming in contact with the air. The following analyses show this very clearly:—

Waste-Gas Sample Taken from Top Waste-Gas Flue.

Carbonic acid	16·5 per cent. by volume.
Carbonic oxide	2·9 ,,
Oxygen	*Nil.*

Sample Taken from Waste Gas-Flue above Damper.

Carbonic acid	11·6 per cent. by volume.
Carbonic oxide	*Nil.*
Oxygen	7·8 per cent. by volume.

It will be seen from these that, had the secondary-air slides been altered according to any calculation made on the last analysis, such change would have been totally wrong.

When taking samples of gases, it should be remembered that the most fuel gas will be made when the fire has just been clinkered; so that the smallest excess of oxygen will be found in samples taken immediately after cleaning, and the largest excess just before clinkering time. The amount of oxygen that will be in excess in the waste gases just before clinkering, greatly depends on whether the producer is working above its maximum producing power. The following tests for oxygen show this difference:—

Half-hour after clinkering,	Half-hour before clinkering.
1·3 per cent.	7·5 per cent.

The bed on which these tests were made had the secondary-air slides open to admit just sufficient air to burn the largest amount of producer gas the furnace would give under the conditions to which it was set. The primary-air slides should only be opened to admit sufficient air to make the amount of gas required to keep the retorts at the proper temperature, not only on account of the saving in fuel, but also to stop any local heating and cutting action that a large excess of air causes in the combustion chamber. This in some cases is due to the rapid formation of clinker, which stops the passage of primary air into the fuel for the production of gas, and the damper pull acting more on the secondary air than when the fire was first cleaned, causes a shorter flame that heats one portion of the retorts more than another.

If in the getting up of the heats, care has been taken to increase the area of the slides and dampers by small amounts, and sufficient time has been allowed between each opening for the increased quantity of gas to take effect, this will in some measure be avoided.

In order to test whether this limit has in reality been passed, it is occasionally necessary to make an analysis of the furnace gases. To take a sample of gas from a furnace, the writer uses a length of ⅜-inch iron tubing, which is pushed through the sight-hole over the gas-nostrils. When the tube has softened, it is bent, and then pushed down through a nostril, so that the end of the tube will be about 12 to 18 inches below the arch. A plug, with a hole in it sufficiently large to allow the tube to pass through it, is then passed over the tube, and placed in the sight-hole; the plug being then made tight with a little fire-clay. An aspirator, or sample bottle, is connected to the end of the tube, and the sample drawn from the furnace. In order to make sure that all the air has been expelled from the tube, &c., before the apparatus is disconnected, the vessel in which the sample is taken is filled several times with the gas.

There are many pieces of apparatus now used for the analysis of gases, such as those devised by Bunte, Orsat, Hempel, and others, which are now widely used. The Hempel's apparatus, in combination with the combustion tubes devised by Jaeger, has been found useful for the purpose of making partial or complete analyses. The apparatus and reagents are as follows: One 100 c.c. burette complete, filled with saturated water. One potash pipette, containing a 33 per cent. solution of caustic potash to absorb the carbonic acid. Solid pipette, filled with sticks of phosphorus in water, for the absorption of oxygen. Two double liquid pipettes filled with ammoniacal cuprous chloride, to take out the carbonic oxide.

There are several ways of preparing this reagent, which will be found in the various text-books on gas analysis. The following method is the one generally used by the writer: 60 grammes of sodium chloride (common salt) and 30 grammes of crystallized copper sulphate are dissolved in about 200 to 300 c.c. of water. When dissolved, the solution is poured into a flask containing a quantity of copper turnings and about 50 c.c. of commercial hydrochloric acid. The contents of the flask are then boiled for 15 minutes, after which the solution is poured into about 2 litres of water, when the cuprous chloride is precipitated as a white precipitate. This is then allowed to stand for an hour or two, so that the precipitate will settle. The liquid above the precipitate is then syphoned off, and the precipitate is dissolved in the least quantity of ammonium hydrate possible, and the solution is made up to 200 c.c. with water, which will be sufficient to fill one pipette. It will be found that 200 c.c. of the solution will dissolve about 800 c.c. of carbonic oxide before it is exhausted.

After the absorption of the carbonic oxide, the residual gas from a furnace gas, obtained from air, and the steam that is evaporated by the fire, will generally be found to be too poor in combustible gases to be exploded with air by means of the electric spark in the usual way, so that pure oxygen has to be employed in place of air. As this is not always at hand in a gas-works laboratory, the following method was adopted: It will be seen that it depends on the fractional combustion of the hydrogen and marsh gas with copper oxide. The apparatus required is a small hard-glass tube, having a capacity of about 5 c.c., with the ends drawn out so as to form capillary tubes for connecting the apparatus together. This is filled with freshly ignited copper oxide, and placed in a stand, having a cover with a hole in it to take a cork and a thermometer. The stand should be of such height that the tube can be connected to the pipette and the burette by means of small pieces of rubber tubing, and so that a flat-flame bunsen burner can be placed under the tube to heat it.

The method of carrying out an analysis is as follows: The gas to be analyzed is drawn into the burette and the volume adjusted to the zero mark. After this has been done, the gas is passed into the potash pipette, in which it is shaken gently to promote absorption. The gas is then run back into the burette; and after it has been allowed to rest for three minutes (so that the water may drain down the sides of the burette), the liquid is levelled, and the volume of the gas absorbed is read off and noted in the laboratory book. The gas is then passed into the phosphorous pipette, and allowed to stand in it for three minutes, after which it is run back into the burette, and the volume absorbed read off as indicated above. For the determination of carbonic oxide, the gas is run into one of the cuprous chloride pipettes, in which it is shaken for three minutes, after which it is passed back into the burette, and the pipette is replaced by the second and freshest cuprous chloride one. The gas is passed into this and shaken for another three minutes, after which the volume of gas absorbed is read off, with the same precautions as for carbonic acid.

The burette containing the residual gas is now connected to the combustion tube by means of a small piece of capillary tubing and a small piece of rubber. The tube containing the copper oxide is now heated by the flat-flame bunsen, until the thermometer stands steady at 250° C. When the temperature is steady, the free end of the combustion tube is connected to the potash pipette, and the gas passed slowly over the heated copper oxide three times. After the gas has stood in the burette for five minutes (or until the volume is constant), the amount of the gas that has disappeared is noted as hydrogen. The end of the combustion tube connected to the potash pipette is now disconnected, and the tube heated to redness. When the temperature has become constant, the gas is passed through it again three times, into the potash pipette, and back into the burette. After it has been allowed to cool, the volume of gas burnt is read off. The gas left in the burette is nitrogen, which can be read off directly from the burette.

The method of stating the results in the laboratory book is as follows:—

CO_2	= 2·8 c.c.	absorbed	= 2·8	per cent.	by volume.
O	= 2·8 ,,	,,	= 0·0	,,	,,
CO	= 33·4 ,,	,,	= 30·6	,,	,,
H	= 37·4 ,,	,,	= 4·0	,,	,,
CH_4	= 38·4 ,,	,,	= 1·0	,,	,,
N			= 61·6	,,	,,

The following are two analyses of gases taken from the producer at different times after the fire had been clinkered:—

	One-and-a-half Hours after.		*Seven-and-half Hours after.*	
CO_2	5·2 per cent. by volume		2·8 per cent. by volume	
O	0·0	,,	0·0	,,
CO	27·4	,,	31·3	,,
H	5·6	,,	5·0	,,
CH_4	0·6	,,	0·2	,,
N	61·2	,,	60·7	,,

Waste gases contained—

Oxygen 2·6 per cent. by volume. Oxygen 7·8 per cent. by volume.

When these analyses are calculated to the amount of waste gases they will produce, containing the amount of air found in the actual tests, it will be seen, that, an hour-and-a-half after clinkering 197·6 volumes, and seven-and-a-half hours after 287·87 volumes had been produced from 100 volumes of furnace gas, which is an increase of 46 per cent. As the dampers, &c., had not been moved during these experiments, it will be seen that only about 54 per cent. of producer gas was being made seven-and-a-half hours after clinkering, taking that made at an hour-and-a-half after as 100. During these tests, the average temperature of the retorts was 1670° Fahr. On cutting down the amount of primary air, and readjusting the secondary air and dampers, the difference in the calculated volumes of the waste gases became 13·5 per cent. for the same periods after clinkering, during which time the average temperature of the retorts was 1760° Fahr., and the saving in fuel was 5 lbs. per 100 lbs. of coal carbonized over that in the first experiments.

These show the importance of the proper regulation of the primary-air supply as well of the secondary air, if the maximum saving is to be secured from gaseous firing.

As a general rule, the furnace gas should not contain more than 3 or 4 per cent. of carbonic acid, and the waste gases not more than 4 per cent. excess of oxygen just before clinkering time, when the generator is working properly.

It frequently occurs that a bed of retorts which has been working satisfactorily for some time after careful adjustment, will gradually cease to heat evenly, though the air-slides and dampers have not been interfered with. Sometimes the heat will be found to have gone to the bottom retorts, and sometimes to the top ones. When the bottom retorts are found to be heating most, or more than they were intended to, it is necessary to cut off a little secondary air, so that the flame in the combustion chamber will become longer, and thus heat higher up the setting. The cause of this shortening of the flame is in many cases due to the fuel containing more ash than that which was being used when the bed was first set to work; for with the increased amount of ash, the grate-bars become clinkered up more quickly, and soon stop the free passage of primary air into the fuel, so that the quantity of producer gas is less than that to which the slides were set. Another cause is allowing the bed of fuel to get too low on the grate-bars, when the carbonic acid is not completely converted into carbonic oxide, or the primary air has too free a passage through the fuel, and the setting is converted in some measure to a direct-fired one. It is necessary to keep the bed of fuel in the furnace from 2 feet to 4 feet thick when air alone is used, and from 3 feet to 6 feet for steam and air, in order to ensure the best results from the producer.

When the heat has been travelling towards the top of the bench, short-circuiting should be looked for, as it shows that the flame has become too long for even heating. This is due to insufficient air being admitted into the combustion chamber to burn the gas within required limits. In order to do this, one of the top plugs in the waste-gas flue should be suddenly drawn from the sight-hole, while a sharp look-out should be kept for any unburnt gas, which, as soon as it reaches the air, will burn with a blue flame. When this is found, more secondary air should be admitted, in order to burn the gas in the combustion chamber. In very bad cases, it is sometimes necessary to increase the damper in order to get sufficient air into the setting, as this cannot be dealt with by opening the secondary-air slide. If no short-circuiting can be found, the lengthening of the flame may be due to the fuel containing less ash than that which was first used; so that the quantity of producer gas will be larger. In this case, the primary-air slides should be shut a little at a time, until the gas is properly burnt.

When the dampers are altered to increase or decrease the temperature of the retorts, care should be taken to see that the air-slides are reset so that the maximum efficiency can be got from the setting and the fuel used.

In conclusion, I may say that it is impossible, in a paper of this description, to go into every point that may arise in this most interesting subject.

The Gas Question in Paris.—The Paris Municipal Council have had before them on several occasions lately the perennial question of the future supply of gas in the city; and at the sitting on Monday last week, a resolution was adopted by 41 votes to 35, sanctioning the production and distribution, under municipal control, of "light, heat, and motive power," as well as the sale of residual products. For the management of this business, seven members of the Council will be nominated, and the Prefect of the Seine will select five of them. Although, judging from this decision, the matter has been definitely settled, the project has to receive the sanction of Parliament.

YORKSHIRE JUNIOR GAS ASSOCIATION.

Meeting at Bradford.

A Meeting of the Association was held in the Lecture Room of the Bradford Municipal Technical College on Saturday—Mr. W. CRANFIELD, F.C.S., of Halifax (the President), in the chair. Notwithstanding the prevalence of dense fog, the attendance was even larger than at the inaugural meeting (*ante*, p. 290).

The PRESIDENT, in opening the proceedings, said he was exceedingly pleased to see so large an attendance, in spite of the inclement weather. The success which had attended the inaugural meeting had led the Council to decide on having the report of the proceedings reprinted in pamphlet form from the "JOURNAL OF GAS LIGHTING," and distributed to every member, so as to form a permanent record of the transactions of their Association. Before they went on with their formal proceedings, he should like to refer to an article which had appeared in the "American Gas Light Journal," which contained some reference to themselves. He read the article, and reminded the members that the eyes, not only of the British Gas Associations, but those of their American friends, were upon them. Dealing with the question of the relations of the Senior to the Junior Gas Associations, he expressed regret that at that meeting they had not had any word of encouragement from the former. He was disappointed, because a Senior Association very near to them had recently met, and the occasion had passed by without any public reference or any kindly recognition of the Junior Association. They would have welcomed some word of encouragement—if not of endearment—from the Association. He welcomed the new members present, and expressed the hope that they would get to know one another thoroughly. He sincerely trusted they would not allow their meetings to refrigerate, and if any member wanted an introduction to another member, the Secretary or he would be very glad to arrange it. The President concluded by appealing to the members for papers for discussion at subsequent meetings.

The HON. SECRETARY (Mr. Fred Scholefield, of Dewsbury) said that since their inaugural meeting one of their members (Mr. H. Wilkinson, of Leeds) had left the district to take up an appointment at Cambridge. He moved that the members should tender to him their hearty congratulations. Letters of regret for non-attendance were read from Mr. H. Townsend (Wakefield) and Mr. Hamilton (Hull). Mr. Scholefield said he was sure the members would be delighted to know that he had received a letter from Professor Smithells, intimating his gratification at the warmth of his reception at the inaugural meeting. He also stated that the Yorkshire College authorities had assured them that rooms at the College were always at the disposal of the Association whenever they wished to hold meetings there. He was glad to say that the members of the Association now numbered sixty.

The PRESIDENT said the Council wished to hear from the members whether the day and hour of meeting were convenient. They would like to have an expression of opinion as to the suitability of Friday evening or Saturday evening, in preference to the present arrangement of holding their meetings on Saturday afternoons.

No suggestion being forthcoming,

The PRESIDENT said that he must take the members' silence to signify consent; and the meetings would consequently continue to be held on Saturday afternoons.

GASEOUS FIRING.

Mr. J. F. SMITH (Halifax) then read a paper entitled "Notes on Gaseous Firing," the text of which will be found on p. 682.

At the close of the paper,

The PRESIDENT said the members were under a deep sense of gratitude to Mr. Smith, whose paper was a most careful and elaborate examination of the thermal reactions taking place in the production of heats, which had been justly esteemed to be a most important part of the process of carbonization. The paper formed a most elaborate, useful, and convincing treatment of the question. After tracing the stages by which gas-works had reached their present forms of regenerator furnaces, the President went on to say that another point of great interest to them was Mr. Smith's instance of the introduction of steam, and the reduction of heat in the regenerator, with consequent saving in its construction, and the transferring of that heat to the actual setting. He hoped Mr. Smith would add to the debt they already owed him by bringing the Jaeger instrument to some future meeting and allow them to inspect it.

The members were then invited to discuss the paper, either orally or by written questions; but, owing to its comprehensive nature, and the lateness of the hour, it was suggested that a more favourable opportunity for its discussion would be afforded at the next meeting, when a reprint would be in their hands.

The PRESIDENT intimated that he was perfectly agreeable to this course, if the members wished it.

Mr. SMITH remarked that before the paper was reprinted he might find it advisable to "edit" it. He reminded the members that they were Juniors, and not Seniors; and though questions were invited, they need not be afraid to speak out.

Mr. G. W. FLIGG (Dewsbury) moved that the discussion on the paper be adjourned until the next meeting, as the information

they had received was so very ample, and took so wide a range, that one could scarcely venture to ask any questions at such short notice.

The PRESIDENT said he sympathized with the members. He had attempted to read through the paper all the morning, and he had not even now settled all the questions he wished to ask.

The only questions of any importance put to the writer of the paper were by the Honorary Secretary and another member.

Mr. SCHOLEFIELD asked what would be a satisfactory temperature of the waste gas at the outlet of the main flue into the chamber.

Mr. SMITH replied 580°.

Mr. SCHOLEFIELD said that he had tested some waste gas on the previous day at his works, and found it averaged from 220° to 240° Fahr. He wished to know whether Mr. Smith considered this a satisfactory temperature.

Mr. SMITH replied that he considered it very satisfactory—in fact so satisfactory that he thought if he were Mr. Scholefield he would have his thermometer examined to see if it was right.

Another question asked was whether the various changes in the wind would materially affect the working of the settings and also the figures shown in the paper.

Mr. SMITH replied that no doubt the varying changes of the wind would affect his figures. The pull of the chimney had a lot to do with the matter, as in the case of a strong wind it would be more on the secondary than on the primary air. In the one case they might find a trifle more carbonic oxide going in, and in the other they might get 2 or 3 per cent. more of oxygen. A great deal was attributed to "wind and barometer" in heating retort-settings that really ought to be put down to coal. When slack had been put in the settings, or the coal had been out in rain or snow, the invariable answer of the foreman, when spoken to, was: "Oh, the wind has changed." But he (the speaker) often found it was nothing of the sort. He did not believe that atmospheric changes had so much to do with the working of retorts as was generally supposed. In answer to a further question, the speaker added that he had purposely refrained from specifying either "inclined" or "horizontal" retorts, as this would have been provocative of a long discussion. In connection, however, with inclined retorts, he thought the construction of the bed was wrong. In his opinion, it should be at the same angle as the retorts themselves.

No other questions being put,

The PRESIDENT proposed, and Mr. SMITH seconded, a hearty vote of thanks to the authorities of the Technical School for the use of the room.

Mr. E. BENN (of the Gas Laboratory, Leeds) proposed a hearty vote of thanks to Mr. Smith for his interesting paper.

Mr. L. V. WHITTAKER (Wakefield) seconded the proposal, which was cordially received.

The usual vote of thanks to the Chairman brought the proceedings to a close.

THE NEXT MEETING.

The PRESIDENT announced that the next meeting would take the form of a visit to the Halifax Corporation works, and would be held early in February.

BRITISH ASSOCIATION OF WATER-WORKS ENGINEERS.

The Eighth Winter Meeting of the Association was held on Saturday, in the Geological Society's rooms, Burlington House. The President (Mr. R. H. SWINDLEHURST, M.Inst.C.E., of Bolton) was in the chair; and the attendance was above the average.

The SECRETARY (Mr. Percy Griffith) read the minutes of the annual meeting held at Bolton last July; and they were unanimously confirmed.

A TRANSFER.

Mr. Alfred J. Jenkins, Assoc.M.Inst.C.E., Water Engineer of Jersey, was transferred from Class A of associates to membership.

THE TRAINING AND REGISTRATION OF PLUMBERS, AND STANDARDIZATION QUESTIONS.

The SECRETARY, who was delegated by the Council to attend a conference convened by the Worshipful Company of Plumbers on Nov. 17, read the report on the subject which he had presented to the Council. In the course of it, Mr. Griffith stated that the conference was attended by fifteen gentlemen representing municipal water authorities (of whom seven were members of the Association), three gentlemen representing the Royal Institute of British Architects, and four gentlemen representing the Worshipful Company of Plumbers, one of whom—Dr. Robert Cranford, Warden of the Company—presided. After an introductory address, the Chairman moved the following resolution: "That this conference of architects and water authorities approves the efforts of the Worshipful Company of Plumbers to secure the more efficient training of plumbers, and the registration of qualified men, and pledges itself to support the Company in their endeavour to secure the necessary legislation in furtherance of that object." After discussion, the resolution was put to the conference, and carried. Mr. Searles Wood, F.R.I.B.A., then moved the following resolution: "That, with the object of giving practical effect to the previous resolution, the representatives of the Royal Institute of British Architects and the water authorities present, recommend that preference be given to the employment of registered plumbers to carry out and inspect plumbers' work executed under architects and water authorities." After a lengthy discussion, the resolution was put to the conference, and carried. The questions of standardizing fittings and other materials used by plumbers, and the standardizing of water authorities' rules and regulations, were then introduced; and, at the conclusion of the discussion, the conference unanimously agreed to request the Worshipful Company of Plumbers to continue their work in connection with the various points under consideration. As to future procedure and the constitution of a General Committee to carry out the objects agreed upon, the following resolution was proposed by Mr. Searles Wood, seconded by Mr. F. J. Bancroft, and carried unanimously: "That a Committee representing the Worshipful Company of Plumbers, the Water Authorities, the Royal Institute of British Architects, and the British Association of Water-Works Engineers (represented by two members) be formed to consider the question of standard bye-laws, regulations, fittings, and workmanship, and that the gentlemen present be constituted such a Committee, with power to add to their number." The Committee then adjourned; it being understood they would meet again at an early date. Since the conference, Mr. Griffith has had an interview with Mr. Coles, the Clerk to the Worshipful Company of Plumbers, at which he expressed the great satisfaction the Company felt at the intervention of the Association. Various points connected with future procedure were then discussed; and he was in a position to say that the co-operation of the Association in such procedure would be cordially welcomed and highly appreciated. The Council, at their meeting the previous day (the Secretary proceeded to remark), passed resolutions confirming his (Mr. Griffith's) action and adopting his report, and appointing Mr. P. H. Palmer, of Hastings, and the Secretary as their representatives on the Joint General Committee referred to.

On the motion of the PRESIDENT, seconded by Mr. W. MATTHEWS (Southampton), the members agreed to a resolution signifying their approval of the resolutions passed by the Council.

PAPERS AND DISCUSSIONS.

The reading and discussion of papers followed—the subjects and authors being: "The Storage of Flood Water," by Professor HENRY ROBINSON; "The New Reservoir for the Hoylake and West Kirby Water-Works," by Mr. A. J. JENKINS (now) of Jersey; "The Cogan Extensions of the Cardiff Corporation Water-Works," by Mr. NEIL J. PETERS, of Cardiff. Abstracts of the papers and discussions will be published in succeeding numbers of the "JOURNAL."

APPOINTMENT OF OFFICERS AND NEW MEMBERS.

The SCRUTINEERS (Mr. G. O. H. Klopp and Mr. J. S. Hodgson) reported the following elections, as the result of the ballot:—

President—Mr. Francis J. Bancroft, of Hull.

Vice-Presidents—Mr. E. A. B. Woodward, of Wolverhampton; and Mr. P. H. Palmer, of Hastings.

Ordinary Members of Council—Mr. William Millhouse, of Scarborough; Mr. William Matthews, of Southampton; Mr. C. E. Jones, of Leyton; Mr. H. Ashton Hill, of Birmingham; Mr. W. H. Humphreys, of York; Mr. Thomas Bower, of West Hartlepool; Mr. H. E. Stilgoe, of Dover; Mr. T. N. Ritson, of Ramsgate; and Mr. G. Greenslade, of Southampton.

Honorary Secretary and Treasurer—Mr. W. G. Peirce, of Richmond.

The following gentlemen were admitted to membership:—

Members—Mr. J. Chisholm, of Airdrie, N.B.; Mr. R. S. Henshaw, of Portland; and Mr. G. J. Hunt, of Dorchester.

Associates—Mr. A. P. Fisher, of Torquay; Mr. R. H. Fox, of Torquay; Mr. C. E. Oxbrow, of Maldon; Mr. F. M. Sainty, of Rayleigh; Mr. H. Swinney, of Chepstow; and Mr. A. F. Ward, of Chelmsford.

THE NEXT MEETING.

Mr. BANCROFT thanked the members for the high honour they had conferred upon him in electing him President for 1904; and he asked the members to make Hull their place of meeting. He gave them a cordial invitation there, and assured them that they would be made very welcome by the Corporation. They would all do their best to make the meeting interesting and instructive to the members. It was proposed to meet on the second Thursday in June, to conduct the official portion of the proceedings in Hull, and then adjourn on the Saturday, and visit Antwerp and other places on the Continent.

Mr. T. EASTON DEVONSHIRE (the Chairman of the Antwerp Water-Works Company) tendered a warm invitation to the President and members to visit Antwerp, and asked them to look upon the Water Company as their hosts during their stay in that city. By that time, he expected the Company would have a new pumping-station, with everything up-to-date, in course of construction. The old works had been very much talked and written about by their Manager, Dr. Kemna—more especially in connection with their system of filtration, by which what was considered one of the worst waters in the world was turned into a good one.

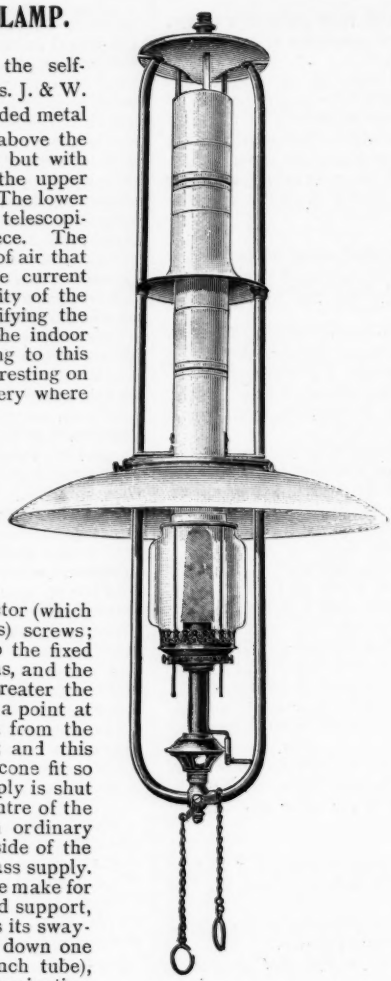
The PRESIDENT, on behalf of the Association, heartily accepted the invitations to visit Hull and Antwerp.

Votes of thanks to the President and officers and to the Geological Society concluded the proceedings.

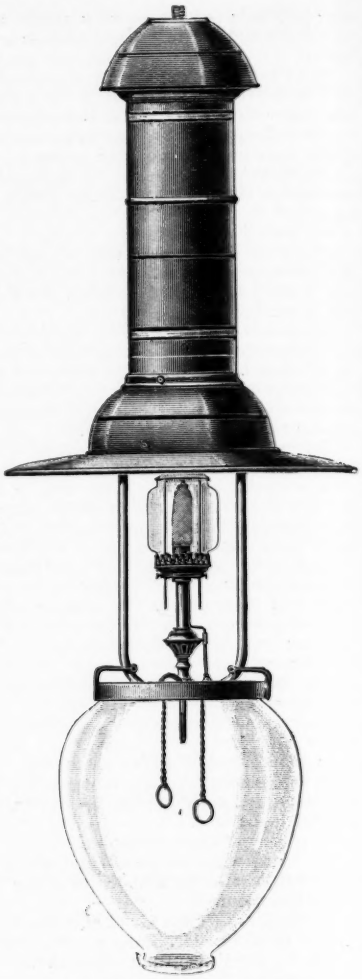
"SICLOPS" SELF-INTENSIFYING LAMP.

A strong and prepossessing gas-lamp of the self-intensifying class has been brought out by Messrs. J. & W. B. Smith, of Farringdon Road. It has the extended metal chimney for inducing a rapid upward draught above the glass globe after the manner of its forerunners, but with this difference, that the tube is in two parts—the upper one having a bell-shaped mouth at the bottom. The lower one is of rather smaller diameter; and it slides telescopically into the bell-mouthed end of the top piece. The effect of this is that the secondary upward flow of air that is produced has an accelerating effect on the current ascending from below; and the increased velocity of the current that this gives rise to assists in intensifying the incandescence of the mantle. In the case of the indoor lamps, the metal chimney is enamelled. Owing to this arrangement of the chimney, there is little weight resting on the small glass globe. Around the burner gallery where the globe rests is an asbestos ring, for the purpose of making an air-tight joint there.

The burner is of fairly large proportions; and plentiful provision is made for the supply of air to it. The regulation of the gas according to pressure and any other condition of the supply that necessitates its control, is effected by the ingenious application of a well-known principle. Inside the part of the burner where the gas-injector fits there is a cone, with a single outlet at the apex. Into this cone the injector (which contains four holes for the emission of the gas) screws; and it follows that the tighter it is screwed up to the fixed inside cone, the smaller becomes the supply of gas, and the farther it is removed from the fixed cone the greater the supply of gas. When the supply is regulated to a point at which the greatest efficiency is being obtained from the burner, a back-nut is screwed up tight by hand; and this locks the injector in position. The injector and cone fit so true that, by screwing the former home, the supply is shut off completely. The bye-pass burns in the centre of the burner top, just at the point where usually, in ordinary burners, the fork-holder is situated; and at the side of the burner is a thumb-screw for regulating the bye-pass supply. The mantle (which is of the usual strong and large make for this type of burner) is suspended from an arched support, which keeps it in a central position, and prevents its swaying about. The gas supply to the burner passes down one tube of the frame (composed of strong brass $\frac{5}{8}$-inch tube), and that to the bye-pass down the other. The illuminating power of the lamps, both the indoor and outdoor types, is stated to be 700 candles.



INDOOR LAMP.



OUTDOOR LAMP, WITH GLOBE LOWERED FOR CLEANING.

The indoor lamp is fitted with a good domed reflector. The outdoor lamp combines all the features of the indoor lamp; but, in addition, the top is enclosed in an enamelled casing, and the bottom part in a large globe, which is supported by an iron ring at the top. From this ring there extends inwards, in opposite positions, two small brackets which are slotted and finished with cotter pins, in order to form apertures for the sliding of the globe up and down, and its support on, the frame for cleaning purposes, without accident. The bottom of the globe is provided with a brass fitting of an open pattern, which does not obstruct the light, but at the same time keeps the lamp windproof. The lamps are well constructed, and finished in a manner which pleases.

OFFICE ORGANIZATION.

With the stress in commercial and professional life engendered by competition or growth of business, the necessity of adopting the best form of office organization which will economize time is borne upon one more and more. It is an old accepted truth that "time is money;" but that should, in business matters, be supplemented by another to the effect that "the saving of worry contributes to the preservation of health," which again tends to the comfort of all concerned from the chief to the very lowest of his subordinates. By paying a visit to the Stolzenberg (Patent) File Company, of 50, Bishopsgate Street Without, one can get a good grounding in the primary principles of method in conducting a business establishment which permeate ease throughout the work and operations, and accelerate their performance and dispatch.

The Company have worked up a system, which has for its base simple flat files, and nests of cabinets for their orderly reception, which can be built up in various forms to suit any position. The system is a simple refinement, which is secured by much less labour than is expended on old slipshod methods, which have in the past, and still do in the present in many cases, waste a vast amount of precious time. The system lends itself to all business establishments and professional occupations; and this general assertion, of course, embraces gas and water suppliers and plant manufacturers. We are fortified in this statement by the fact that numerous engineering firms, a few water companies, and a large number of municipal authorities have adopted it in their various departments; and from the evidence seen at the office of the Stolzenberg Company, the old phrase "once used, always used," and increasingly so, can be appropriately employed. To have the whole correspondence and transactions referring to any particular matter or individual neatly bound up in a single case, so that one can put his hand on any one or more of the papers instantly, without incurring anything but a moderate expenditure of the first instance, is a desirable condition; and that is the purpose of the system under notice.

The flat files consist of covers of stout manilla paper (of more than one quality according to the use to which it is likely to be put), and of various sizes. They are made with corrugations down the back, so that they will lay perfectly flat, and will only extend as their filling with letters or documents proceeds. The papers are readily bound by a steel binder and sliding catches, which firmly lock the contents into the covers, so that the papers are kept in chronological order. Classification of the files is secured by the ingenious employment of different colours and letters; and, by such expedients, the applications and subdivisions to which the system adapts itself are surprising. The second unit in the formation of the system is the cabinet, which, being made in various sized sections, can be built up piecemeal, and in a manner to fill any position in an office. They are also manufactured in various styles, and are of first-class workmanship. The Company, too, have brought out several useful auxiliary articles; and they have invented various office fittings—such as desks—all of which aim at facility of reference. We cannot describe the system in greater detail; but of this we are convinced, that it provides for bringing the internal work of an office (especially an office engaged in a large business with many suppliers and customers) under a simple methodical arrangement. All that the Company want to know is the nature of the business and the requirements; and they can adapt their system to it. The literature they supply, or better still a visit to their showrooms, will prove the correctness of what is said here.

At the Chemical Society recently, a paper was read by Mr. A. F. Girvan on "The Union of Carbon Monoxide and Oxygen and the Drying of Gases by Cooling." The author experimented to ascertain whether the drying of an explosive mixture of these gases by exposure to low temperatures prevented chemical union when the gas was sparked after regaining the ordinary temperature.

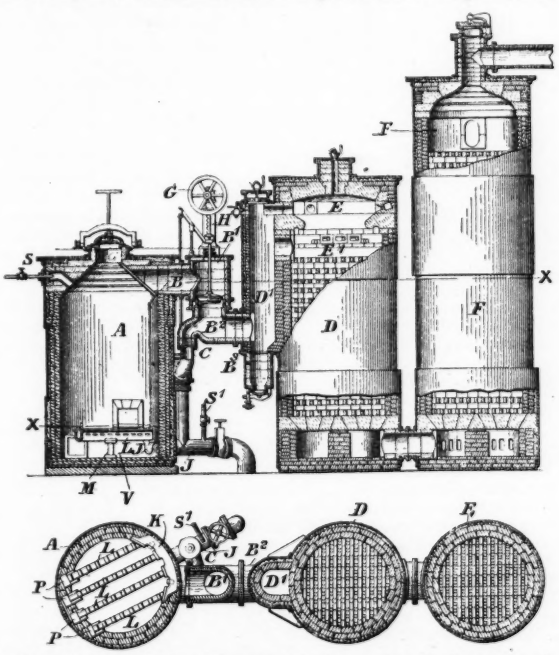
REGISTER OF PATENTS.

Manufacture of Carburetted Water Gas.—Holmes, E. D., a communication from O. N. Guldlin, of Fort Wayne, Indiana, U.S.A. No. 26,769; Dec. 4, 1902.

This invention relates to apparatus for manufacturing illuminating water gas—more particularly the pipe and valve connections between the generator and carburetting and fixing chamber, and certain improved features of construction in the carburetting and fixing chamber. The object of the invention is to provide for more evenly and quickly heating the fuel to incandescence in the generator, and more effectively decomposing steam, resulting in an increased percentage of carbonic oxide and a corresponding decreased percentage of carbonic acid in the water gas. Also to provide an extended height of carburetting and fixing chambers, containing a greater extent of heating surfaces, so that such surfaces may be of a lower temperature than has hitherto been employed—for example, a dull red heat, for converting the oil vapours, by longer exposure, into rich hydrocarbon or heavy carburetted hydrogen gas, of high candle power, without loss of illuminants in the form of lamp-black or hard carbon, or the formation of marsh gas. Further, to provide for better arresting and removing ashes in the pipe and valve connection between the generator and the carburettor; and for better carrying the oil vapours from the vaporizing and mixing-chamber down into the combining and fixing chamber below, where they are combined with the water gas to make fixed illuminating gas.

The illustration represents a vertical section partly in elevation of the generating apparatus; also a horizontal section on the irregular line X.

The gas-generating furnace A is constructed of an iron shell and fire-brick lining in the usual manner, and is provided at the top with a fuel



opening closed by a lid and fastening device, and at the bottom by the usual ash and clinker openings with suitable doors. A steam supply-pipe S connects with the top of the generator through a cast-iron or steel box secured in the fire-brick arch as shown; and another valved steam-pipe S^1 connects with the blast-pipe J, leading into the blast-box and distributing pipes at the grate level. The gas outlet-pipes B and C connect respectively at the top and bottom of the generator, and are, in practice, each provided with a valve-box like the box B^1 at top. The pipe C preferably connects with the air-blast pipe J, which opens into the blast-box at the base of the generator. The gas outlet-pipes B and C connect through the delivery-pipe B^2 with the uptake-flue D^1, or the pipe C may connect directly to the flue D^1, which is connected with the chambers or compartments E E^1 of the carburetting and fixing chamber D. The cylindrical valve-box B^1 is connected between the gas outlet-pipe B and the delivery-pipe B^2, and is provided with an annular hollow seat for a ball-valve.

At one side of the chamber D is constructed the brick-lined up-take flue D^1, having at its lower end the ash-receiving chamber or pocket B^3, closed at the bottom by a tight-fitting door. The gas-pipes, valve-box, ash-chamber, and up-take flue are preferably lined with the fire-bricks as shown. To the ball-valve is attached a rod, to which, in turn, is connected a rack-bar, which extends up into the valve-stand H, where it is engaged by a pinion (not shown) having a hand-wheel G, supported at the top of the stand.

The up-take flue D^1 is connected by an opening with the compartment E^1, and by the smaller opening with the oil vaporizing compartment E of the carburetting and fixing chamber D, so that water gas may be passed into both compartments. The flue D^1 serves as an arresting and deposit chamber for ashes and cinders, and such solid matter, which is carried by the blast and other gases from the fuel-bed in the generator, is precipitated in the flue D^1, and deposited in the ash-pocket B^3 at the lower end, so that it does not pass into and clog the passages and compartments in the carburetting and fixing chamber D. The carburetting and fixing chamber D, and the superheater F, are made high as compared with the generator, in order to provide an increased extent of heating surface, so that the hydrocarbon vapour and gas may be combined with the water gas and made into fixed illuminating gas at a lower temperature, "resulting in a saving of valuable illuminants, which would otherwise be lost by overheating of the hydrocarbons." The carburetting and fixing chamber D is constructed with an open brick arch near the bottom for supporting the checker-work, and forming a bottom gas-chamber. Near the top, it is preferably provided with inwardly projecting annular fire-brick tiles, forming the upper oil vaporizing compartment E, with a large central opening. Oil supply-pipes or injectors are placed in the wall of the compartment E (but may be otherwise located), for supplying oil spray or vapours to be mixed with the water gas admitted.

Air is admitted into the upper part of the compartment E^1, for burning the producer gas brought in for heating the brick chequerwork below. The lower end of the chamber D is connected to the lower end of the superheater F. The superheater is constructed with a bottom brick arch and brick chequerwork above, and is provided at the top with a short smoke stack having a tight-fitting lid. The gas take-off pipe connects with the stack and extends down into a seal-box (not shown), preferably located on top of the charging floor.

The air-blast box K is preferably placed in the brick lining of the generator at about the grate level, and has secured to it the desired number of perforated air-distributing pipes L, preferably arranged and supported in such a manner that they will not obstruct the ash-chamber V. The free ends of the pipes L rest upon shoes or brackets P, permitting expansion or contraction under changes of temperature. The pipes are provided with lateral ports, and at the top with notches or spacing devices arranged in lines between the ports, for receiving the grate-bars (not shown), so that jets of air or steam may be discharged from the ports between adjacent grate-bars directly into the body of fuel. The details of the construction and arrangement of these blast-distributing pipes are fully described in patent No. 22,701 of 1902.

An air-blast pipe J connects with the box K, and has a valve for shutting off air when gas is passed out through the blast-box to the gas outlet-pipe C, or when steam is admitted through the pipe S^1 to the blast-box.

Since the air-blast is admitted in divided streams into the body of fuel in the generator at increased pressure or volume for more quickly and uniformly heating it to incandescence, an increased quantity of ashes and cinders is apt to be carried by the blast gases out of the generator, and, without some special provision for arresting them, would be carried into the carburetting chamber D, and there mixed with hydrocarbons or tarry matter, forming hard deposits, which would clog the spaces in the chequerwork. In order to overcome this difficulty, the up-take flue D^1 is provided. The flue D^1 extends up inside the cylindrical shell to an inwardly projecting tile, and is provided with a horizontal opening for admitting gas and air into the compartment E^1. Vertical ports are made in the tile and partly in the brick lining, for permitting part of the water gas and blast gases to pass into the vaporizing compartment E. An air-blast box I, having a valve seat and a globe valve, is secured to the iron shell at the upper end of the flue D^1, and an opening connects the box with the flue D^1 in line with the opening. A air-blast pipe J^1 connects with the box I, so as to be controlled by the valve. Air, when admitted to the blast-box, passes through openings and mixes with the producer gas flowing up through the flue D^1; and the mixture passes into the compartment E^1, where combustion takes place.

The operation of making gas would be conducted as follows: A fire is kindled on the grate and fed with fuel heated to incandescence in the usual manner; but the air-blast is admitted to the blast-box K, at a high pressure of from 20 to 24 inches or even higher, or at a lower pressure in materially increased volume, and is discharged in jets between the adjacent grate-bars, causing complete, rapid, and even combustion of the fuel, so that a deep body of fuel is uniformly heated to incandescence in (it is said) much less time than in apparatus hitherto used for the purpose. The blast gases are passed through the pipe-connections, up-take flue, and openings, into the compartments E and E^1 of the carburetting chamber, where the combustible gases are burned by the jets of air admitted. The hot products of combustion and unconsumed gases pass down through the chequerwork in the chamber D, and thence into the superheater F. Air is admitted where required for completely burning the gases and heating the chequerwork to the desired temperature. The waste products finally escape through the stack. The oil vaporizing and mixing compartment E is partly heated by radiant heat and partly by the burning of blast gases entering through the smaller opening; some of the air-ports being inclined upward for directing streams of air into the compartment E for that purpose. The body of fuel having been heated to incandescence, and the chambers D and F heated to the desired temperature, the air-blasts are shut off, and water gas is generated by admitting steam into the blast-box, from which it passes through the pipes L, impinging on the incandescent fuel "in the identical places previously acted on by the jets of air." Rapid and uniform decomposition of steam is thus said to be effected—producing hydrogen and carbonic oxide, with material reduction of the carbonic acid, and permitting longer periods of gas making, which, with the shorter periods of blast, effects a large increase in the capacity of the apparatus. Steam having been passed into the body of fuel, oil is sprayed into the vaporizing-chamber E. As the hot water gas rises through the flue D^1, it passes partly into the compartment E, where it mixes with the oil vapours and carries them down into the compartment E^1, where the additional and larger volume of water gas is mixed with it; and the gases and vapours are completely combined and then converted into fixed illuminating gas in passing through the chequerwork in the chambers D and F. The gas finally passes off to the usual seal-box, and thence to the washer and scrubber (not shown). The hydrocarbon vapours passing down into the compartment E^1, are met by the stream of water gas, and are thereby enveloped "so that the hydrocarbon illuminants will not be destructively decomposed, and deposited as lamp-black and hard carbon."

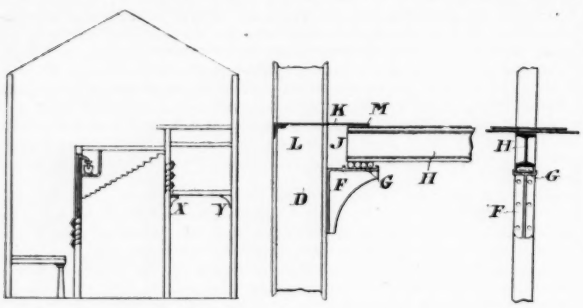
After the gas-making run is completed and the apparatus again heated up, as described, a reverse or down-run can be made if steam is

admitted through the pipe S at the top of the generator, and passed down through the incandescent fuel, where decomposition is effected. The resulting water gas flows out through the pipes L through the blast-box, and off through pipes J and C and up-take flue D^1 into the carburetting and fixing chambers, or may be passed out of the ash-pit by a separate pipe to the pipe and valve connection.

Charging and Discharging Stages for Inclined Retorts.—Cutler, S., of Millwall, E. No. 960; Jan. 14, 1903.

This is an expansion device in connection with the stages used for charging gas-retorts. The patentee proposes to dispense with the usual rigid connection between the stage girders and the buckstays, and carry one end of the girders upon roller bearings, by which means the buck-stay can move without causing a corresponding movement in the stage and building. Also, as it is desirable for the flooring of the stage to be maintained in contact with the face brickwork of the retort-bench, an overlapped marginal floor plate is provided, to extend along the face of the bench and attached to it, and of sufficient width to cover the arranged expansion space. The overlap is left free and not attached to the underlying floor plates of the stage; thus the lappage will automatically increase or decrease to correspond with the expansion or contraction of the brickwork of the retort-bench and buckstays.

A general view of a retort-bench is given, with the charging stage and the walls of the building. X indicates the position at which the expansion device is preferably placed, though in some instances it may

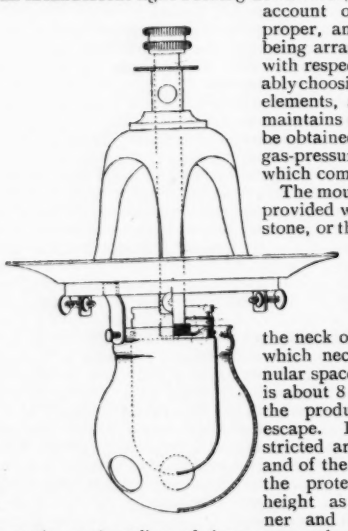


be alternatively placed at Y. A side sectional elevation of the expansion bearing and a front sectional elevation of the expansion bearings are also given.

To the buckstays D of the retort-bench, or alternatively to the stanchions or walls C of the building, are attached brackets F, upon the top tables of which are fitted a series of turned rollers G, forming bearings for the girders H. The brackets and girders are thus free to move independently, and any expansion of the retort-bench results in a decrease of the gap J, instead of causing distortion of the walls of the building. To maintain the continuity of the floor plates while allowing for the movement of them relatively to the buckstays, there is provided an overlapping marginal floor plate K, which, being maintained at the face-line of the retort-bench by the angle-bar L, is free to move at the overlap M without causing similar movement of the main flooring.

Inverted Incandescent Gas-Burners.—Graetz, M., of Berlin. No. 1234; Jan. 17, 1903.

The patentee claims that the attempts hitherto made to manufacture an incandescent light burning downwards, have not been successful on account of the mantle, the burner proper, and the protecting body not being arranged in a suitable position with respect to one another. By suitably choosing the position of these three elements, as shown in the sketch, he maintains that a good combustion can be obtained according to the different gas-pressures and other circumstances which come in question.

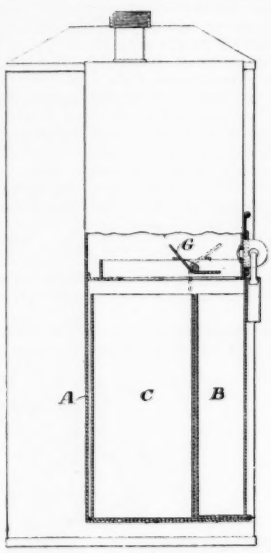


The mouth of the gas supply-pipe is provided with a flange made of metal, stone, or the like. Around the mouth is placed the ring for holding the mantle, which ring is arranged at the same height as the burner. Around the ring is placed the neck of the protecting glass body, which neck is so large that two annular spaces are formed (each of which is about 8 mm. broad), through which the products of combustion must escape. In consequence of this restricted area for the exit of the gases, and of the arrangement of the neck of the protecting body at the same height as the mouth of the burner and as the upper end of the mantle, a throttling of these gases takes place. Part of the gases escapes upwards through the inner annular space between the burner and the mantle holder, after having heated the mantle. The greater part of the gases, however, penetrates through the meshes of the mantle, and escapes through the outer annular space. But consequent on the space being relatively small, the gases are kept back and throttled, whereby the heating of the mantle is augmented.

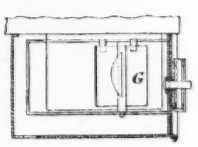
The arrangement of the neck of the protecting body at the same height as the mouth of the burner has for object, not only to form a small annular space for the escaping gases, but serves at the same time to prevent too strong a flow of the outer air into the protecting body, provided as it is with perforations in its lower part, as shown, in order to equalize the differences arising in the developing of the gaseous products of combustion.

Coin-Operated Gas-Meters.—Green, W. O., of Brentford, and George Glover and Co., Limited, of Chelsea. No. 1400; Jan. 20, 1903.

This invention relates to money-box arrangements of coin-operated gas-meters, and has for its object "the prevention of the abstraction of the money by unscrupulous users and others." There are two boxes or receptacles for the money—one a secret box intended to receive all the coins after the first. The other box receives only the first coin inserted in the machine; and "in case a person attempts to steal the money, he will be deceived by the boxes, and will abstract only the contents of the first box containing the single coin, and leave the secret box untouched."



A is the fixed casing enclosing two boxes—viz., a front box B and a secret box C situated behind, and so constructed and arranged that when the front box (which is the only ostensible money-box) is withdrawn, the rear box C appears to form a part of the meter-casing when seen from the front. Above the



boxes, and immediately underneath the automatic coin-mechanism of the meter, is arranged a tilting balance G, which is initially set, as shown by full lines, so that the first coin inserted in the machine falls on the balance and then drops into the money-box B. The weight of the coin falling on the tilting balance turns the latter over into the position shown in dotted lines, and the balance then operates to deflect all the succeeding coins into the secret box C. After the money-box has been emptied by the properly authorized person, he sets the tilting balance to again deliver the first coin subsequently inserted in the machine into the front box B.

APPLICATIONS FOR LETTERS PATENT.

25,483.—Langfield, J., "Recess gas-fire grate." Nov. 23.
25,488.—Tournier, V. C., "Rotary gas-engines." Nov. 23.
25,524.—Zechnall, L., "Inverted gas-burners." Nov. 23.
25,552.—Scott-Snell, C., "Gas-taps." Nov. 23.
25,626.—Morrell, R. L., "Gas-engine governors." Nov. 24,
25,698.—Ladd, J. H., "Bodies adapted for lighting purposes, and rendered incandescent by heat or electricity." Nov. 24.
25,699.—Jensen, P., "Gas-burner with lighting attachment." A communication from Carl Nielsen. Nov. 24.
25,763.—Hovine, E., and Breuillé, H., "Producer gas." Nov. 25.
25,801.—Praag, D. J. van, "Generating acetylene." Nov. 26.
25,816.—Cleland, J., and Stewart, J. C., "Acetylene gas generator and purifier." Nov. 26.
25,823.—Corfield, G., "Gas-stove." Nov. 26.
25,846.—Lake, H. H., "Burners." A communication from the Best Street-Light Company. Nov. 26.
25,912.—Davies, J., "Gas-engines." Nov. 27.
25,939.—Scott-Snell, C., "Intensified system of gas lighting." Nov. 27.
25,948,—Tattersall, H., "Incandescent gas-lamps." Nov. 27.
26,005.—Fearnhead, J., "Gas-stoves." Nov. 28.
26,010.—Beal, W., "Anti-vibrators." Nov. 28.
26,032.—Parton, W., and Budgen, E., "Acetylene generators." Nov. 28.
26,063.—Wohlfeil, J., "Gas illuminations." Nov. 28.
26,065.—Riess, H., "Burners for gas and oxygen." Nov. 28.
26,135.—Babel, G., "Prevention of freezing in pipes." Nov. 30.
26,140 —Flachshaar, P., "Gas-burners." Nov. 30.
26,192.—Westley, J., "Cocks for gas or water." Dec. 1.
26,196.—Harrison, A., and Crawford, W., "Regenerative gas-furnaces." Dec. 1.
26,197.—Hodgson, W., "Valve for gas or water." Dec. 1.
26,285.—Keith, J. & G., "Lighting gas-burners." Dec. 1.
26,327.—Hayes, J., sen., & J., jun., "Wet gas-meter." Dec. 2.
26,336.—Warren, W. P., "Liquid hydrocarbon gas." Dec. 2.
26,416.—Colville, D., and Sons, Ltd., and Hislop, C., "Gas-producers." Dec. 3.
26,430.—Beal, W., "Anti vibrator." Dec. 3.
26,433.—Arendt, O., "Incandescent burner for lamps suspended in an inclined or horizontal position." Dec. 3.
26,556.—Kerness, J., "Purifying gas." Dec. 4.
26,596.—Schweich, E., "Producer gas." Dec. 4.
26,638.—Beal, W., "Incandescent gas-burners." Dec. 5.
26,654.—Lyst, F., "Gas and other engines." Dec. 5.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Incandescent Burners for Slot Consumers.

SIR,—The wide-spread adoption of the prepayment system for the supply of gas, testifies to the favour with which it has been welcomed by the industrial classes. Probably few recent inventions have added more to the comfort, cleanliness, and health of their homes. Nevertheless, the majority of gas companies have hitherto been content to provide these prepayment consumers with the old-fashioned flat-flame burner, while loudly proclaiming that for the better class of house property, as well as for church and street lighting, nothing but incandescent burners should any longer be tolerated. Yet it is in the homes of our wage-earning class—where the cubic space per inmate is limited, where, for economy's sake, the consumption of gas is kept at its lowest, and where the poor seamstress strains her weary eyes for many a long hour in her efforts to supply the children with bread—that the best, cheapest, and least air-contaminating light should be provided. Surely the health and welfare of our working classes have in this respect met with but scant consideration!

The explanation is probably to be found in the fear that the mantles will be insufficiently taken care of by cottagers, who will neither incur the trouble nor spend the necessary coppers to replace the damaged article. Moreover, under such circumstances, the light emitted from a broken mantle may be even less satisfactory than that yielded by the time-honoured flat flame. But these arguments do not supply a sufficient answer; and the difficulties referred to are readily surmountable. Mantles are cheaper and less fragile than in former years, and anti-vibrators are, if need be, a further addition to our *armamentarium*. Nor should the great mass of slot consumers be penalized because of a careless minority

Happily the day seems dawning when incandescent lighting will at length be introduced into the homes of our working classes; and as a contribution to this question, the paper recently read before the Manchester District Institution at Halifax by Mr. Mottram (which appeared in the "JOURNAL" for Dec. 1, p. 539) deserves attention. A well-devised system of regular inspection and maintenance of incandescent burners by special employees will go far to obviate difficulties. Such a system may be made both profitable to the company and advantageous to the consumer; while at the same time it will promote a friendly connection between the two parties.

Lastly, apart from the social aspect of the question, the extension of incandescent gas lighting into cottage homes will hasten the general adoption of this improved form of gas lighting. Such general adoption will, in its turn, facilitate the lowering of the standard illuminating power, and eventually permit of a material reduction in the price of gas.

Abbotsbrook, Reading, Dec. 8, 1903. JAMIESON B. HURRY, M.D.

The Permanency of Benzol.

SIR,—In your issue of Jan. 7, 1902, a leaderette appeared in which it was stated that the Leeds City Council had appointed a Committee to inquire as to the permanency of benzol enrichment of coal gas. I have carefully watched the "JOURNAL" for the result of this inquiry, but without success.

I am Gas Examiner on behalf of a Corporation against the Gas Company, and have held my appointment for nearly twenty years. Some two years since, cannel was abandoned as an enricher, and benzol substituted. I have carefully watched (by daily tests) the effect of this mode of enrichment, as indicated by the behaviour of the gas at the argand and the readings of the photometer, which is situated upon the Company's works; and, so far, my experiences lead me to doubt if enrichment by benzol is of any real value to the consumer. Unfortunately, we have no means of ascertaining how far the benzol vapour travels with the gas through the district, as we have no testing-station outside the Company's works.

If some of those who are using benzol for enrichment, and have means of testing both at the works and in the district, would give your readers the benefit of their experiences, I feel sure the information would be highly appreciated.

Dec. 5, 1903. GAS EXAMINER.

The London County Council's Gas-Testing Bill for Next Session.—At the meeting of the London County Council on Tuesday, the Parliamentary Committee brought up the draft of the Bill proposed to be introduced next session to amend the Gaslight and Coke and other Gas Companies' Acts in regard to the testing arrangements in the Metropolis, the chief points of which were noticed last week (p. 626), and it was approved.

Reinstatement of Roads after Main-Laying.—At the meeting of the Lewisham Borough Council on Wednesday, the Works and General Purposes Committee reported that they had had under consideration the subject of certain proposed agreements with local Gas and Water Companies with respect to the repair of trenches opened for the laying of service and other mains and pipes. The work of reinstating the roads and paths broken up had for some time been done by the Companies themselves; but, owing to complaints, the Committee recommended the Council to make agreements for the execution of the work by the Council according to a scale of charges which they had adopted for repayment of the expenses incurred. The Council had concluded agreements with the Lambeth Water Company and the South Metropolitan Gas Company, and negotiations were proceeding with the Kent Water Company. The Committee proposed that the agreements already completed should come into operation at the beginning of the new financial year—April 1, 1904. The report was adopted.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Monday, Dec. 7.

(*Before Lords Justices* VAUGHAN WILLIAMS, ROMER, *and* STIRLING.)

London County Council v. South Metropolitan Gas Company.

The Sunday Gas-Testing Question.

Mr. WARMINGTON, K.C., Lord ROBERT CECIL, K.C., and Mr. LAURENCE ROSTRON appeared for the appellants; Mr. T. R. HUGHES, K.C., and Mr. T. T. METHOLD represented the respondents.

At the close of Mr. Warmington's argument, reported last week,

Lord ROBERT CECIL followed on the same side. On the point as to whether or not the London County Council were the right plaintiffs in the action, he submitted that it was clear they were claiming an injunction to ensure the performance of a public duty, not for one to restrain the defendants, their servants and agents, from having access to the testing-places. Upon this point one had to see whether the Council had been entrusted with the duty of representing the public in this matter. The general scheme of legislation was plain. It was that certain officers were appointed to protect the public in the matter of impurity of gas; but the clause did not enable the County Council to send Gas Examiners when they pleased. On the contrary, it was plain that they could give no directions at all; the Examiners had to take their instructions from the Referees. It had been decided more than once that a local board could not arrogate to itself the duty of representing the public when the injury was really to the public.

Lord Justice VAUGHAN WILLIAMS said, supposing the appellants were right, the Council could not call upon the Examiners to make a test upon a date that was not appointed by the Referees.

Lord R. CECIL said he should certainly so contend. He was not arguing whether they had a right to test on Sundays, but merely as to whose servants they were.

Lord Justice ROMER thought the testing-place was to be under the control of the Council, in order that they might manage it, and take care to see that proper testing took place.

Lord R. CECIL said he did not think they had anything to do with the testing.

Lord Justice ROMER: But they have to see that such testing as the Gas Referees have provided shall take place. It is their duty, having control of the testing-place, to see that it is used for the tests.

Lord R. CECIL: If your Lordship thinks so, that is an end of the case.

Lord Justice ROMER: Why do you think they had given to them the control of the testing-places?

Lord R. CECIL: Merely to see that the apparatus was there, and that it was not tampered with by anyone.

Lord Justice ROMER: The Gas Referees have power to say when testing shall take place. Suppose they say the testing shall take place on Wednesday; then it would be the duty of the County Council to take care and see that the testing-place was open.

Lord R. CECIL: If that is so, there is nothing in the point.

Lord Justice ROMER: It is not only "control," but "management" of the testing-place.

Lord R. CECIL: If the action had been framed to restrain the Company from interfering with the control or management, he would have had to consider the point; but this was not the form of the action.

Lord Justice ROMER said it was in substance, though perhaps not in form, as the Secretary of the Company had written stating that access to the testing-place would not be allowed on a Sunday. This point was also connected with the second point—namely, the penalty section—because the plaintiffs were not suing for a penalty, but applying for an injunction.

Lord R. CECIL submitted that, according to the decisions of the Court, an injunction would not lie.

Lord Justice VAUGHAN WILLIAMS said if the Act of Parliament and direction of the Referees were to prevail against the Company, then, though shutting out the Examiners would not give a cause of action, it would nevertheless go to conclusively prove that the Company had interfered with the Council in the performance of their duty.

Lord R. CECIL said that might be so, according to the definition put upon the expression "control and management of the testing-place." But that was not the point. The Referees were appointed as impartial persons between the consumer and the Company. Representatives of the Company were allowed to be present to see that the test was carried out in accordance with the provisions of the Act; but all the County Council had the right to do was to see that the apparatus was in proper order. They had no right to be present at the testing.

Lord Justice STIRLING: That is where I cannot agree with you.

Lord R. CECIL next dealt with the point of whether there was a remedy attached to this offence by statute; and, if so, whether the plaintiffs (if the right persons to sue) were not confined to that remedy. He cited several authorities in support of his contention. Passing on to the question which was chiefly argued in the Court below, as to the meaning of the word "daily," he did not suggest that it might not include Sunday, but the point was whether it was so clear that it *must* mean Sunday. He submitted that it was not a bit clearer than the meaning of other expressions of a similar kind, which had been construed either to include or exclude something which *prima facie* they would exclude or include.

Lord Justice VAUGHAN WILLIAMS said, as far as he understood, in cases having regard to lapse of time, where a certain number of days was mentioned, Sunday was always included; but if it was a day upon which something was to be done, that rule did not apply. One might always argue, on any statute, that "daily" or "each day" did not include Sunday. But the difficulty here was that the obligation to

supply gas of a certain degree of purity and illuminating power meant every day; and so it was rather cogent to show that in such an Act "daily" ought to include Sunday.

Lord R. CECIL said he could not conceal from himself that this was a very important observation; but the strength of it was much diminished by the fact that no suggestion had been made, or could be made, that anyone had suffered by the lack of testing on Sundays.

Mr. HUGHES thought his learned friend had better not invite a controversy on this point. All he would say was that he did not admit it.

Lord R. CECIL said there was no suggestion made throughout the case that anyone had suffered for the last thirty or forty years by the omission to test on Sundays.

Lord Justice VAUGHAN WILLIAMS asked if there was anything in the Act of Parliament, apart from the practice of the Referees, which indicated that the tests were not meant to be taken every day.

Lord R. CECIL said, as far as he knew, there was nothing at all which threw any light upon the meaning of the word "daily." But confining it to working days made excellent sense of every section, as was proved by the fact that this meaning had been attached to it for more than thirty years, and it had not led to any inconvenience.

The Court here rose for the midday interval. On returning,

Lord R. CECIL continued his argument. He said ever since 1869 it had been the duty of the Gas Examiners to test the gas daily; and if this included Sunday, they had neglected their duty in that respect, not only in London, but all over the country. He then read portions of Sir George Livesey's evidence, given at the trial, as to the universal practice in this respect. His points were two—first, the universal practice not to test on Sunday; and, secondly, that there was undoubtedly a tendency in the law to avoid Sunday labour altogether. He did not want to press the Sunday Observance Acts unduly; but it was only right to consider the strong terms in which Parliament had laid down that no Sunday labour which was avoidable should take place. He then briefly referred to 5 and 6 Edw. VI., the Act of Chas. II., and 3 and 4 Wm. IV., and read a passage from Blackstone, which pointed out in strong terms the extreme reluctance of Parliament to direct any work to be done on Sunday, and cited different laws from the time of Athelstane onwards. He submitted that it could not possibly be said that the expression "daily" was so peremptory and clear that only one meaning could be given to it. Such expressions as "daily paper," "daily cause list," and attendance "daily" at an office during particular hours, were in common every-day use, and no one ever supposed they included Sunday. He submitted, therefore, that the practice which had been established was one which Parliament might well have considered in passing the Act in question, and that the fair inference was that they intended the word to have the same meaning as had been given to it under the previous Acts. On this point he relied on the cases cited by his learned leader, and might add to them *Hawkins v. Gathercole* (6 De G. M. and G. 1). He submitted, therefore, that the action ought to be dismissed.

Mr. HUGHES commenced his argument for the respondents by saying that the only point raised in the Court below was as to the true construction of the Act of Parliament, and, in fact, his friend Mr. Warmington said in opening that both sides desired to have the opinion of the Court on this point, in order that the true position of the authorities and the Gas Companies might be ascertained. After that, it was rather funny to hear his friend raising as a new point that there was no jurisdiction. There appeared to be no serious dispute that the word "daily" *prima facie* meant every day, including Sundays, partly having regard to the fact that the obligation to supply gas extended to Sundays. One could hardly imagine that the obligation to supply pure gas was not co-extensive with the obligation to supply it at all; but if it could not be tested on Sundays, it would follow naturally that the Company were not bound to supply the same gas on Sundays as on weekdays. It also followed, if there were no tests between midnight on Saturday and midnight on Sunday, that two "gas days" were interfered with, because a portion of each was included in the Sunday. He did not see how Sunday could be treated as a *dies non* under the Act, having regard to the mode in which the testing was carried out. The test for purity was prescribed to occupy not less than 15 hours, which would be from 9 a.m. to midnight, and then the results had to be ascertained and calculated.

Lord Justice VAUGHAN WILLIAMS asked if Mr. Hughes meant to suggest that there had never been an Act of Parliament in which such a phrase as "on the day next following" had been construed to mean that Monday was the next following day to Saturday.

Mr. HUGHES said he knew of no Act of Parliament in which it had been held that Sunday could be excluded under such words. Under the Rules of Court, there was an express provision to that effect, where in calculating short periods of time Sunday was excluded.

Lord Justice VAUGHAN WILLIAMS said he thought there was a similar provision in an Act of William IV., though it was not now in force.

Mr. HUGHES then, at the invitation of their Lordships, read the judgment of Mr. Justice Joyce as given in the "JOURNAL" for the 12th of May.

Lord Justice VAUGHAN WILLIAMS asked if Mr. Hughes questioned the proposition that where there had been a series of Acts passed with regard to one subject—and in practice one meaning only had been attributed to the terms used—the last Act of the series must be taken to sanction the interpretation which had in practice been put on the earlier Acts. It was not only Lord Macnaghten's opinion; Lord Chief Justice Tindal said much the same thing.

Mr. HUGHES said it might be so in certain cases. If, for instance, there had been decisions in the Courts on the construction of an Act of Parliament, and then a subsequent Act was passed in the same words, there, he should say, the inference was that the Legislature adopted the interpretation. That, however, applied rather to positive Acts; this was a negative one. Supposing the true construction of the Act of 1869 was that there should be testing on Sundays, the neglect of that duty did not lead to the inference that there was no right to do it. If the Legislature intended to bring to the notice of local authorities that they were not to neglect this duty any longer, they could not have done it in plainer words than they employed in the Act of 1880 The fact that the Metropolitan Board of Works or the London County Council did not for some time think it necessary to test on Sundays, did not relieve them of the statutory obligation. The learned Counsel quoted several cases to show that, at Common Law, Sunday was reckoned as an ordinary day, and could not be treated as a *dies non* except where it was expressly made so by statute. He then proceeded to argue at some length as to the difficulty of carrying out the tests for purity, which occupied 15 hours, if Sunday was entirely excluded.

Lord Justice VAUGHAN WILLIAMS asked what had been done on Sundays. As a matter of fact, had there been any practical difficulty in this respect?

Mr. HUGHES was unable to say that there had been.

Lord R. CECIL said he understood the purity test was automatic. It shut itself off at the end of 15 hours; and it was merely a question of going to the room at any time afterwards and ascertaining the result.

Lord Justice STIRLING asked if there was any evidence of what had been prescribed by the Referees with regard to testing.

Mr. HUGHES said it was in what was called their "Notification," which prescribed that for illuminating power there should be three tests daily, at intervals of not less than one hour; but it did not prescribe the particular hours. The test for purity was to extend over not less than 15 hours on each day, and should be made with 10 cubic feet of gas. It must be started between 9 a.m. and 5.30 p.m., and be finished before 9 o'clock on the following morning. It was concluded by the action of an automatic governing meter, which stopped the passage of gas when 10 cubic feet had passed.

Lord Justice STIRLING remarked that the operation might be started at 9 o'clock, and it would go on for the proper time, and then be examined on the Monday.

Mr. HUGHES said the report of the Examiner had to be made on the following day.

Lord Justice VAUGHAN WILLIAMS asked if this meant the day following the commencement or the finishing of the test. When it said the immediately preceding day, did that mean the day on which the results were read, or the day upon which the chemical test was first commenced?

Mr. HUGHES thought it had all to be done in the one day.

Lord Justice VAUGHAN WILLIAMS said it could not possibly be all done in one day, looking at the directions. If they began on Wednesday morning, and followed the directions, they would not get the results until some time in the forenoon on Thursday. Would the report on Friday be the proper day for the result?

Mr. HUGHES submitted that the report must be made on the Thursday.

Lord Justice ROMER pointed out that the test for pressure must be ascertained in two halves. Under the Act of 1876, it was to be the average from midnight to sunset and from sunset to midnight. He did not see how they could divide it into two periods. If they took it for the whole period between 9 a.m. on one day to 9 a.m. the next day, how could they get the period from sunset to midnight on Sunday?

Mr. HUGHES said it was impossible. He submitted on this point that the plain meaning of the word "daily" was every day; and no ground had been shown for supposing it was meant to exclude Sunday. The learned Counsel proceeded to argue the point which had been raised as to jurisdiction, and referred to several authorities. He also dealt with the third point—as to whether the County Council were the proper plaintiffs in the action—and submitted that, as the controlling authority, they had an obligation cast upon them to see that the Act was properly carried out, that they had to direct the Gas Examiners to attend on the Sunday, and that therefore they were the proper plaintiffs.

Tuesday, Dec. 8.

Mr. HUGHES this morning resumed his argument on the question of jurisdiction, which had been raised by the appellants on section 34 of the Gas-Works Clauses Act, 1871, which imposed the penalty of £5 for not giving proper facilities for carrying out the Act. He pointed out that the provisions of the Act were much less effective than those of the Special Act, and less stringent in two respects. In the first place, under the Act of 1871, testings could only be carried out at certain hours of the evening; but under the Special Act they could be made during the whole 24 hours. On the other hand, the forfeitures were much less stringent. Another difference was that the Act contained no provision that the testing-places should be under the control and management of the Local Authority. The penalties for deficiency in pressure were 40s. a day, and as regarded illuminating power the penalty was not to exceed £20; whereas under the Special Act the forfeiture for deficiency in illuminating power was dependent upon the quantity supplied. With regard to purity, again, the forfeiture for deficiency was £50 for each station. However, he had a complete answer to this point. His learned friend Mr. Warmington said that by section 1 of the Act of 1871 the General Act of 1847 and that Act were to be read as one; then that the Act of 1847 was incorporated with the Act of 1860, and that therefore the Act of 1847, the Act of 1871, and the Act of 1860 were all to be read as one. In this contention, he believed his learned friend was right. It was, in fact, decided by the case of *Commercial Gas Company v. Scott*. Therefore the provisions of the two Gas-Works Clauses Acts were to be read as if printed in the Act of 1860, and were therefore applicable to the Metropolitan Gas Companies. This he understood to be his learned friend's argument. [Mr. WARMINGTON assented.] That being so, there was fortunately a very clear and complete answer. Section 55 of the Act of 1860 said this: "Provided that no special remedy or provision for giving relief to any person given by this Act shall prejudice or diminish the general jurisdiction of any of Her Majesty's Superior Courts of Law or Equity over or with respect to the acts or defaults in respect to which the special remedies or provisions are so given." That section was quite plain. It seemed to have anticipated the very argument which was addressed to the Court on the previous day; and he was very glad to have had his friend's assent to the proposition. Taking it on either alternative—either assuming the General Act of 1871 was not made

applicable to the South Metropolitan Company until 1881 (*i.e.*, after 1880), or taking the other alternative—in either case there was a complete answer to that point.

Lord Justice VAUGHAN WILLIAMS remarked that, notwithstanding this, it was necessary to have the right plaintiff.

Mr. HUGHES said he was only suggesting that it was an answer to the point which had been raised, that, the penalty being given by the Act of 1871, the other remedy was taken away. If once that were got out of the way, it was only a question of parties, which was an objection that should have been raised in the Statement of Defence, and dealt with in the Court below. But if their Lordships thought the Attorney-General ought to be present, he had no objection to applying for his consent to be added. Of course, it would be in his discretion.

Lord Justice VAUGHAN WILLIAMS said it was not a question of parties altogether. To his mind, the question was whether the present plaintiffs had a cause of action.

Mr. HUGHES said he had indicated the sections giving the control and management of the testing-places to the controlling authority, which was the London County Council. They had to appoint the Gas Examiners, and they were to this extent under the control of the County Council, and it was for the Council to insist on their doing their work properly.

Lord Justice VAUGHAN WILLIAMS: Where do you find that? I find power to appoint "impartial persons;" but that does not lead immediately to the conclusion that the people so appointed are to be your servants.

Mr. HUGHES said he quite admitted, as he had done before, that the Council had nothing to do with the mode in which the Examiners did their testing; that was to be laid down by the Referees. But within those limits, the right of seeing that the Examiners did their duty rested with the Council. It was for them to see that they did so, and to discharge them if they did not.

Lord Justice VAUGHAN WILLIAMS: Is that an inference from the power of appointment? I do not find anything which specifically says so.

Mr. HUGHES said if a man was incompetent, he must be discharged, and another appointed in his place.

Lord Justice VAUGHAN WILLIAMS said it would require some argument to satisfy him that these impartial people were removable. He could not assent easily to the proposition that a person was to be chosen because of his impartiality, and that he was then to be removed at the instance of one of the parties interested.

Mr. HUGHES said the County Council were not interested in any way. They had simply a duty imposed upon them, because they were what the Act called the controlling authority. Section 2 of the Act of 1880 defined the controlling authority—being the Corporation in the City of London, and the Metropolitan Board of Works in other places. Over and over again the controlling authority was referred to; and its duty was to see that the provisions of the Act were carried out. For instance, section 5 said that the Gas Referees should from time to time, after giving notice to the authority, visit the testing-places. Section 6 provided that the examiners should, in the mode prescribed, test the pressure at least every hour, and in such street or such part of a street as the authority might from time to time by order in writing appoint. Then section 10 provided that the Gas Company might, if they thought fit, send a representative on each occasion of testing; and the authority should state at what time it was proposed to make such test on any particular day, on being requested to do so by the Company the day before—showing that the controlling authority had to fix the time of testing. The Gas Referees specified the minimum number of tests—being at least three each day; but subject to that, it was the authority which controlled the examiners, and directed them how and when to make the tests. By section 11, the examiner had to make his report on the result of the testings to the controlling authority, the Gas Referees, the Chief Gas Examiner, and the Company. Sections 12, 13, 14, and 15—in fact, the whole purview of the Act—showed that it rested on the controlling authority, not as a party interested, but as a public authority, to see that the provisions of the Act were carried out. The only means by which the Act could be enforced was by providing that the gas examiners should have access to the testing-places at all times at which they ought to make tests. If they were refused access, the Act became a dead-letter at once. In point of fact, the practice throughout had been that the Metropolitan Board of Works, and subsequently the London County Council, had had a complete staff of gas examiners entirely under their control, subject to the limitation he had mentioned. He submitted, therefore, that the Statement of Claim was perfectly sound in the way in which it asked relief; and no objection was taken in the Court below. Both parties treated it as a question of the right of the Companies to refuse access to the testing-stations on Sundays. This was made perfectly clear by the correspondence before the action, and by the evidence of Sir George Livesey. Counsel read a letter of Dec. 11, 1902, from the Secretary of the defendant Company to the Clerk of the County Council, which concluded with these words: "The only answer the Chairman can give to your letter is that the Council's testers will not be admitted to the Company's testing-places next Sunday." He there used an expression "the Council's testers," which he (Counsel) ventured to think was substantially accurate. Something had been said with regard to the necessity of testing on Sunday. It was not necessary to deal much with this point, because it was for the Council to judge; but he would point out that defendants did not say that testing involved any additional labour on their servants. Their servants need not be present, though they were entitled to be. What they said was—and this was in Sir George Livesey's evidence—that, in order to comply with the tests, they must work on Sunday; the reason being that unless the men were kept charging the retorts continuously, the product given off was poor, and the gas of insufficient illuminating power. This was the defendant's case; and the evidence showed that the Company themselves made tests on two or three Sundays, and found that the gas was below the illuminating power required by the Act. Sir George Livesey said they could not help this, except by employing additional Sunday labour. The plaintiffs entirely objected to this statement; it was only a question of cost. There was a well-known process of enriching gas, so that they could supply it of the right illuminating power on Sundays as well as on week days.

Lord Justice VAUGHAN WILLIAMS asked whether any change had been made in the process of gas-making since 1869.

Mr. HUGHES really could not answer the question.

Lord Justice VAUGHAN WILLIAMS said he put the question because the practice had been not to test the gas on Sundays for the last forty years; and it occurred to him that perhaps the necessity for testing on Sundays arose from a change in the process.

Mr. HUGHES said very likely there had been changes, and it might possibly be that they had tended in this direction—that unless the men were at work the whole time, the gas would be of poorer quality. At all events, this practice, according to the defendant's own case, had only lasted for eleven years at the time the Act was passed. However, he thought he could answer the question from Sir George Livesey's evidence. He said they used to make gas on Sundays, but gave it up afterwards. When they worked on Sundays there was a smaller consumption, and they made the same quantity of gas on that day as on week days. The stock used to work down from Monday to Saturday; and they looked to making up the deficiency on Sunday. But when they altered the system, it was reversed, and instead of making less gas than they required on each week day, they made more, from Monday to Saturday, and accumulated sufficient in the gasholders to carry them over Sunday. The gas made during the six days was tested, and a portion of it so tested was stored and reserved for use on Sunday; so that it was the same gas as had been tested on the week days. Then he went on to say that the coal put into the retorts at two o'clock was by eight o'clock yielding gas which was really too poor to be stored, and they allowed it to blow off into the air. The net result was that the gas was no worse on Sunday, but, on an average, was rather better, because they blew away a certain proportion; but at times it did not come up to the standard.

Lord Justice VAUGHAN WILLIAMS asked if the statutory obligation continued over every moment, or whether an average was to be taken.

Mr. HUGHES suggested that the obligation continued over the whole time; but with regard to testing, it was decided by the average.

Lord Justice VAUGHAN WILLIAMS: If you keep up your average, you will comply with the obligation of the Act. If during one half hour the gas was not up to the mark, what proceedings could be taken?

Mr. HUGHES said he did not think any could be taken; but, at the same time, he suggested that the obligation was continuous. If two tests were taken, one giving 10 and another 18 candles, or an average of 14, which was the standard, he should certainly say this was not carrying out the obligation.

Lord Justice VAUGHAN WILLIAMS said they were not drawing an Act of Parliament, but dealing with the obligations under the Act; and looking at it, he could find no obligation except in respect of an average.

Lord Justice ROMER asked if it was really material to consider this question. The Acts seemed to contemplate that the gas during part of the day might be below the average.

Mr. HUGHES acknowledged that this was so. He should say the obligation was to supply 14-candle gas; but a forfeiture was not incurred if the average was maintained.

Lord Justice VAUGHAN WILLIAMS said he did not think they had anything to do with the question (assuming the plaintiffs were right) as to what good reason they might have for insisting on Sunday testings. If they had the right, they could insist upon it, and they need not give reasons. But, as Mr. Hughes had said something about it, he thought it was proper to point out, if it came to be a topic of prejudice raised on behalf of the County Council against the Gas Companies, that it failed, because if Sir George Livesey's evidence was right, there was no deficiency whatever on Sunday. If the plaintiffs were right, they could insist on the testing on Sunday without giving a reason. The better the day, the better the deed; but the particular reason given did not seem to be a good one.

Mr. HUGHES said he entirely assented to that. He was only led into making a few remarks on this point by what had been said on the other side; and perhaps it was unwise. With regard to the form of the declaration, he should have no objection to its being changed, if thought necessary, and to its being stated that the controlling authority were entitled to have access to the testing-stations on Sundays. If they had access, they could admit the examiners. It really came to the same thing, and it was only a question of form. At present, the Gas Companies had locked out the County Council, and the examiners as well. If they would admit the Council or their agents, they could admit the examiners. No question had been raised about the form in the Court below; and he submitted that the judgment of the learned Judge was quite right.

Mr. METHOLD having added a few words,

Mr. WARMINGTON replied on behalf of the appellants. He said the facts were quite accurately set out in the Statement of Claim. There was no direction from the Gas Referees to make any test on Sunday.

Lord Justice VAUGHAN WILLIAMS: Is that necessary?

Mr. WARMINGTON said he did not think it was.

Lord Justice VAUGHAN WILLIAMS: Have the Referees anything to do with the question whether they test on Sunday or not?

Mr. WARMINGTON: I do not think they have.

Lord Justice VAUGHAN WILLIAMS said the Referees prescribed the number of tests to be taken per day, but not the days of testing. Was it not within the power of the County Council to give an order to the examiners to test on any particular day?

Mr. WARMINGTON submitted that this was beyond their power.

Lord Justice VAUGHAN WILLIAMS said there was one section giving the controlling authority power to direct a test of pressure to be taken in any particular street or part of a street.

Mr. WARMINGTON said he should urge that, this being an *expressio unius* with regard to a special matter—the pressure—it did not affect the general authority.

Lord Justice STIRLING: Surely the whole frame of the Act is this—that the control of the testing-places is with the County Council. What have the Company to do with it?

Mr. WARMINGTON replied that section 6 gave special powers to the County Council with regard to a special matter; but the like powers were not given with regard to the ordinary tests.

Lord Justice STIRLING pointed out that it was not necessary. The pressure at a particular place was a different thing.

Mr. WARMINGTON said the County Council had appointed special gas examiners for Sunday, and had given them express directions to test on that day. How could tests so made be tests under the Act? The real tests, in the language of section 7, were the number of tests prescribed by the Gas Referees.

Lord Justice ROMER remarked that this was raising an entirely different point.

Mr. WARMINGTON said he thought it was an answer to a question put by Lord Justice Vaughan Williams.

Lord Justice VAUGHAN WILLIAMS said it was not. He thought on the previous day that the matter of the days of testing was controlled by the Gas Referees; but he found this was not so. The controlling authority seemed to have control of the testing-stations.

Mr. WARMINGTON said he quite agreed that the statutory duty was a daily test; but as to which day, the Gas Referees were the only authority to prescribe the number of tests to be taken. They had, probably wisely, decided to give their directions in the exact words of the statute; they simply quoted them. The County Council had given special directions to make tests on Sundays.

Lord Justice VAUGHAN WILLIAMS asked if the Referees had done anything with respect to the other days of the week which they had not done in respect of Sunday.

Mr. WARMINGTON said they had not. They simply prescribed so many tests to be taken daily.

Lord Justice VAUGHAN WILLIAMS said the sole question was the one argued in the Court below as to the meaning of "daily" in the Act of Parliament.

Mr. WARMINGTON said that was so. It had been laid down in more than one case that, in dealing with a public or a *quasi*-public matter, the course that had been pursued by the public authority was to be taken into consideration in construing the last of a series of Acts. This was the basis of his argument. With regard to the other point, he agreed that at the time of the trial it had not occurred to anyone.

Lord Justice VAUGHAN WILLIAMS said the point about jurisdiction seemed a good one until they were directed to section 65 of the Act of 1860; and this seemed to dispose of it

Mr. WARMINGTON said he felt the force of the remark; and he must leave the matter with their Lordships.

Judgment was then delivered as follows.

Lord Justice VAUGHAN WILLIAMS: In this Court we have nothing to do with the question whether the practice of having tests made on Sunday is a convenient one, or one which is advantageous to the public. The practice of having no test on Sunday is one that has existed for a long time; but that is not a reason why we should violate the correct construction of the Act of Parliament, unless the practice has been of such a nature that we ought to impute to the Legislature knowledge of it when it passed the subsequent Acts which have been referred to. In my judgment, the present is not such a case. We merely have to consider the words of section 7 of the Act of 1880, which says: "A gas examiner shall, at each testing-place, make daily such number of tests as the Gas Referees may prescribe," and so on. I cannot doubt that, according to the natural *primâ facie* meaning, the words "make daily such number of tests" mean every day, inclusive of Sundays. I am not at all saying that you may not have an Act of Parliament in which those words were used, which might admit of being differently construed, either by reason of the subject matter of the Act of Parliament, or by reason of the contents of the Act taken as a whole; but that is not this case. Under the General Act of 1847, under the Act of 1880, and also under the Special Acts of the Gas Companies, the obligation to supply gas of the proper illuminating power and quality is a continuous obligation which has to be performed on every day; and, in the nature of things, there is just as much necessity for having the illuminating quality tested on a Sunday as there is upon any other day. Under these circumstances, having regard to the continuing nature of the obligation on every day, including Sundays, I cannot doubt myself but that to "make daily such number of tests," &c., are words which apply to Sundays as well as other days. That being so, the only question is whether one ought to construe these words differently by reason of the practice which, as a fact, has been maintained since at all events 1869, and it may be, for all I know, since 1847. Cases have been cited to show that sometimes you are not only entitled, but bound where you have Acts of Parliament passed in reference to a matter in which there has been a continuity of Acts of Parliament in succession running on the same lines, to take into consideration the previous practice. The strongest case probably of those that were cited is that of *Ewens v. Noakes*, in which there was a judgment, among others, of Lord Justice Thesiger, in which he said, speaking of a case in which there were living in the house, and occupying it, not only the caretaker himself, but his wife and children, and in which the question was whether the occupation came within the exemption of the statute: "While it is true that we ought not to construe an Act itself by looking at the practice which has taken place in carrying the Act out, it is equally true that we are entitled to construe a subsequent Act, not only with regard to the actual words used, but also with regard to the practice which had grown up and existed at the time the subsequent Act was passed." That undoubtedly is a strong authority for saying that such practice may, in the case he had described, be taken into consideration in construing the Act of Parliament; and I do not propose to depart from, or whittle down, the proposition in any way. But what did the Lord Justice mean? Did he there mean the practice by persons who have a statutory duty thrown upon them, and who for a considerable number of years have neglected to perform that which, according to the natural construction of the words, would be their duty? I think not. I do not think he means to say that one is always to impute to the Legislature a knowledge of that neglect of duty by those who have a statutory obligation thrown upon them. If it is not always that this imputation is to be made, when is it to be made? I think it is in those cases in which it is reasonable to impute such knowledge to the Legislature. A case in which it has very usually been done is this: Very often, on the antecedent or earlier Acts, in similar frame, on the same subject-matter, the very question of the interpretation of a particular section or particular words has come into Court for decision; and the Court have put a construction upon the words in the earlier Acts of Parliament. When you come to the later Acts, and the Legislature uses identical words, I think it may fairly be supposed that the construction of those words is the same—that the Legislature did not pass the subsequent statute without knowledge of the previous decisions on the same words in similar Acts of Parliament. Take again the fact which was the actual case in *Ewens v. Noakes*. There the knowledge which was imputed to the Legislature was the practice of a public department in respect of the inhabited house duty; and one can quite understand that such practice might be supposed to be within the knowledge of the Legislature. But I do not think we ought to carry that so far as to say that the Legislature must have had within its knowledge and view the practice of the gas examiners as to holding no tests upon Sundays. Under these circumstances, it seems to me that we must affirm Mr. Justice Joyce's decision, and hold that the words "make daily" include every day of the week, Sundays inclusive. Several cases were cited which it is not necessary to go into now, because matters were called to our attention by Mr. Hughes which disposed of those cases. I am not sure myself that the pleading is so drawn as to really cover the case which is now made on behalf of the County Council; but even if in form it is not correct, I think we ought to disregard that, because Mr. Hughes has stated, without any contradiction from the other side, that the question which both parties intended and wished to have decided here was whether or not, under the section, these testings could and ought to be made on Sundays. That being so, we should make any necessary alteration in the form of the Statement of Claim. I think, therefore, we are bound to hold that the decision of Mr. Justice Joyce was right; and the appeal must be dismissed.

Lord Justice ROMER: I also am of opinion that this appeal fails. On what I may call the main question, it appears to me clear that the decision of Mr. Justice Joyce was correct. Whether you look at the defendant Company's Special Act of 1869, the Act of 1876, or the Act of 1880, it appears to me clear, on the construction of these Acts, that the word "daily" means what it says, and does not exclude any day in particular, like Sunday. In fact, on the Acts themselves, if there was nothing but the Acts to construe, I should not really think any substantial argument on the part of the appellants could be or has been addressed to us. The gas is to be supplied on Sunday as well as on any other day; and there is just as much reason why it should be good on Sunday—be of proper purity, and so forth—as on any other day, and why it should be tested on that day as well as on any other day. Nor can I see why, under these Acts, any difference should be attempted to be drawn between a day of the week—say, from Tuesday morning at nine o'clock till Wednesday morning at nine—and between Saturday at nine and Sunday at nine, or Sunday at nine and Monday at nine. I take the hour of nine because, under the Acts, the days are defined to be from nine o'clock on one day to nine on the following day. The only question is—and it formed really the basis of the argument of the appellants on this head—can the plain meaning of the Acts of Parliament be departed from as to the later Acts, because a practice had grown up of not taking tests on Sundays, or because, as I understand, a Police Magistrate may have decided a case which implied that the testing on Sunday was not, in his opinion, obligatory under the Act? I think clearly not. There is nothing in the fact of the practice and in the decision which would justify us in saying that when the Legislature passed the Acts of 1876 and 1880 it did not intend to enact as it had previously enacted in 1869, and to have the word "daily" in the subsequent Act used exactly in the same sense as in the Act of that year. With regard to two other points which were for the first time taken on this appeal, I can only say that, to my mind, with regard to one of them, which is as to whether the County Council are entitled to sue, I clearly think they are. It is suggested that they have not sufficient interest in the subject-matter of this action to justify them in being plaintiffs in the action. The County Council are the controlling authority under the Acts, and, in particular, they have the control and management of the testing-stations committed to them. And why have they had committed to them their control and management? Clearly to enable them to carry out the duties and obligations cast upon them as the controlling authority. The Council find, under the Act, gas being delivered on Sundays. It appears to them that it ought to be tested on Sundays, according to the wording of the Act; but they find the gas examiners—the testing operators—are not allowed by the defendant Company to go to the testing-stations which are under the control and authority of the Council. They find that, having the control, but for the interference of the defendants the testing would go on, because the testers are quite willing and ready to go there to do their duty; but they are prevented from allowing, as the controllers of the testing-stations, the testers to go there, because the defendants choose to say that no test shall be made on the Sunday, and that no person except themselves shall have any access to the testing-stations It appears to me that the Council have sufficient interest, obligation, and rights to justify them in coming to the Court and seeking an injunction to restrain the defendants from excluding practically the Council and the testers from the testing-stations. That, in substance, is what this action is for. The real question behind it is what I have previously indicated, and which I have decided—namely, whether, under the Acts of Parliament, the testing ought to go on on Sunday at all. With regard to the other technical point taken on behalf of the appellants, that seemed to me to have something in it of substance, until it was disposed of by the reference to section 55 of the Act of 1860, which destroyed whatever other weight the argument might have had. It appears to me, therefore, that the appeal wholly fails, and should be dismissed.

Lord Justice STIRLING: I am of the same opinion. I agree with what has been said by Mr. Justice Joyce in the Court below and by my brethren here on the main question raised by this action—namely, whether the word "daily" includes Sundays—and I do not think I can usefully add anything to what has been stated. With regard to the

points which had been raised for the first time in this Court, the one with most substance is that which would exclude the jurisdiction of the Court by reason of a penalty being attached by the Act of 1871 to a refusal on the part of the Gas Company to give proper access to the testing-stations, and so forth. But when the Act of 1860 of this particular Company is referred to, it is found that the jurisdiction of the Courts is preserved; and it has been really admitted by Mr. Warmington that this section affords an answer to the argument raised on the Act of 1871. The other question is as to whether the London County Council are the proper plaintiffs in the present action. I agree with what has been said by my Lord, that that is not an objection to which effect ought to be given, regard being had to what took place in the Court below at the hearing of the action. I also agree with what has been said by Lord Justice Romer; and if it were necessary to decide it, I should be of opinion that the Council were proper plaintiffs. To them, by the Act of 1876, is entrusted the control and management of the testing-places, materials, and apparatus, which are to be provided by the Company; and it seems to me, so far from the Company being entitled to control these places, the view taken by the Acts, particularly that of 1880, is that everything which is necessary to be done for carrying into effect the directions of the Act with respect to testing shall be dealt with by the controlling authority—namely, the London County Council—and not by the Company. That is made very strong in particular by section 10 of the Act of 1880, which, while it gives the Company the power, if they think fit, to be represented by an officer at each testing, provides that the controlling authority shall state at what time it is proposed to make such tests on any particular day, on receiving a request in writing from the Company on the preceding day. This shows that it is for the Company to apply to the controlling authority for the purpose of giving effect to this portion of the Act, and that the Company have not the power of excluding the authority and the persons authorized by it from the testing-stations established under the Act. It seems to me that in this case there was a clear interference by the defendants with the control and management which by the statute is vested in the London County Council. I think, therefore, the appeal fails, and ought to be dismissed.

Mr. HUGHES presumed the appeal would be dismissed with costs.

Their Lordships assented.

Mr. HUGHES then pointed out that, subsequent to the order of Mr. Justice Joyce, who gave liberty to apply, instead of granting an injunction, in the hope that some arrangement could be made (which, however, proved impracticable), a motion was made before Mr. Justice Kekewich, who granted an injunction; and notice had been given of an appeal against it. He presumed that this would be taken as having been dealt with now.

Mr. WARMINGTON said, of course, it must be taken that the appeal against the injunction granted by Mr. Justice Kekewich was before their Lordships, and that the same order would be made. He could not argue the matter further. He asked for a stay of proceedings with a view to going to the House of Lords, with liberty to apply; so that if the County Council saw any danger they could come to the Court.

Mr. METHOLD observed that the other Gas Companies were allowing tests to be made on Sundays.

Mr. HUGHES said there was no reason why the South Metropolitan Company should be in a different position from the others.

Lord Justice VAUGHAN WILLIAMS said it seemed to him that it would not hurt the defendant Company. It might possibly throw a certain amount of labour on the workmen; but it would not hurt them for the time.

A Prepayment Meter Dispute at Barmouth.

At the Dolgelley County Court, last Friday week, the Barmouth Gas Company, Limited, sued Mr. John Hughes, printer, of Barmouth, for the sum of £1 16s. 8d., an alleged balance due for gas supplied between Feb. 13 and April 22 last; while Mr. Hughes put in a counterclaim against the Company for £18 damages for cutting off his gas supply without notice. Mr. Stanley Jones, who appeared in support of the Company's case, stated that in November, 1902, Mr. Hughes was furnished at his printing works in Cambrian Street, with a prepayment meter, which was arranged to give 16 cubic feet of gas for every penny put into the slot; but the Company did not guarantee the correctness of the meter. At the end of each quarter the accounts were adjusted in accordance with the reading of the index. If the gas consumed exceeded the value of the pence put into the slot, the excess would have to be paid for; while, on the other hand, if the money in the slot was more than sufficient to pay for the gas that was registered, the difference would be refunded. When the meter was examined in April, it was found to contain only 7d., while the index registered 7000 cubic feet; and it was then discovered that the valve had been left open through a penny having stuck. A bill was thereupon sent to Mr. Hughes; but he refused to pay. In the course of the case, it was mentioned that the meter was 9d. short when examined in February. Mr. Hughes, who gave evidence, stated that there was no agreement, and nothing was said as to the use of the meter. The reason for his refusal to pay was that he had no idea he was liable for any more than the amount prepaid. After putting a penny in the slot, he thought he was to use the gas till it went out. In cross-examination, he said the last penny he put in was about the middle of March. He could not account for the fact that in April only 7d. was found in the meter. He generally paid 6d. a week during the first quarter; but after March the days were longer, and he did not work so late. In the course of conversation between Counsel and his Honour Judge Gwilym Evans, it was admitted that nothing was said and no claim made in respect of the 9d. shortage in February. Mr. Guthrie Jones, on behalf of Mr. Hughes, said that up to February the gas consumed was 5000 cubic feet; and it was strange that 7000 feet should have been used between February and April, when the days were longer and the printing office was not kept open so late. In giving judgment, his Honour said it was quite clear that the Company intended to sell 16 cubic feet of gas for a penny; and the prepayment mechanism was more or less calculated to supply that quantity. In dealing with other parties, it was the duty of the Company to indicate pretty clearly that the penny was for the purchase of 16 feet of gas; otherwise people who did not understand the machine might reasonably think they were entitled to all the gas they could have for a penny. He gave judgment against the Company. Mr. Hughes's claim for damages for cutting off the gas supply to his shop in High Street was then gone into. It was stated that, after application had been twice made for payment of the amount said to be due on the gas furnished to the printing works, the Company cut off the supply to the shop and removed the meter. For many years gas had been used in the shop, and all sums due for this supply had been regularly paid. No written notice was given that the gas would be cut off; and it was contended that this was an illegal act. After hearing the arguments, and the evidence of the Gas Manager (Mr. Kershaw), his Honour said that the Company not having statutory powers were under no obligation to supply gas; and he gave judgment for them accordingly.

The Aspatria Water Arbitration.

In the King's Bench Division of the High Court of Justice on Tuesday, before the Lord Chief Justice and Justices Lawrance and Kennedy, the action of *The King v. Aspatria and Silloth Joint Water Board* came on for argument. Sir Ralph Littler, K.C., and Mr. Clay appeared for the applicant, Miss Gough; and Mr. Balfour Browne, K.C., and Mr. Roskill represented the respondents. Mr. Roskill said he appeared to show cause against a rule *nisi* for a *mandamus* directed against his clients for the purpose of compelling them to take up what had been described as a supplemental award. The dispute arose out of certain proceedings under an Act by which the Aspatria and Silloth Joint Water Board were empowered to construct certain water-works near Aspatria, on land owned by Miss Gough. In October, 1902, an arbitration was held at Carlisle; and the Umpire (Mr. R. E. Middleton, M Inst.C.E.) stated a special case, which came before Mr. Justice Wright in February last. (See "JOURNAL," Vol. LXXXI., p. 487.) His Lordship made an order that the Umpire should state how much of his award of £4570 was found as payment for water collected, diverted, or impounded, and how much for the injury to riparian and other rights of the soil. Mr. Middleton had made a supplemental award, and the Water Board objected to take it up because there was no direction to him to make such an award, and he had no power to do so. He was ordered to make another assessment, not an award, and to say how much of the £4570 was for injury to riparian rights. He had written a letter in which he said that, in arriving at the sum of £4570 he had not, in fact, included anything for the purchase of the water itself, and that the whole amount had been assessed by him in respect of the interference with the rights of Miss Gough in regard to the subsoil of her lakes. Both parties were appealing from the decision of Mr. Justice Wright, and it would be more convenient that this matter should stand over pending those appeals. Their Lordships, without calling on the other side to reply, ordered the rule to be made absolute, with costs.

Liability for a Liquidating Gas Company's Rates.

At the Limavady Petty Sessions on Tuesday, Mr. W. J. Shannon, a rate collector, sued Mr. John Cunningham, as Liquidator of the Limavady Gas Company, Limited, for £6 2s. 6d., rates due on their premises for six months ending the 30th of September last. Mr. J. E. Procter appeared for the complainant; Mr. Boyle for the defendant. Mr. Procter said the Company had sold their works and undertaking to the Limavady Urban District Council, who took possession on the 17th of July. The rate was struck on the 8th of May, and then became recoverable. The Company after the sale went into liquidation, and Mr. Cunningham was appointed Liquidator. The Chairman (Sir Thomas Lecky) said the Magistrates were unanimous in giving a decree against the Liquidator for the amount sought, with 10s. costs.

Illegally Taking Water for a Traction Engine.

At the Bristol Police Court, on the 5th inst., a case came before the Magistrates in which Walter Bowghay was summoned by the Bristol Water Company for wrongfully taking water from a drinking-trough supplied by them, he not being one of their customers. Mr. Gerrish, who appeared for the prosecutors, said the defendant was in the employ of the Western Road Carrying Company, Limited, who had trolleys to which they attached light engines. On Sunday, the 15th ult., the defendant was seen with one of the trolleys drawn up near the trough. Attached to the boiler of the engine was a pipe, through which water for the engine was being drawn. Defendant told the Bench that the engine had broken down on the previous night, and he brought it home on Sunday. He ran short of water, and would have had either to draw the fire or allow the boiler to be burned if he did not get the water. The Chairman of the Bench (Mr. Boyd) inquired if this was running water. Mr. Gerrish said it was; but there was one of the boilers that would hold from 100 to 200 gallons. If the defendant took water for the engine, and the Corporation had to pay by meter, it would be robbing the Corporation. Defendant said he had come six miles, and there was no water till he reached the trough. Mr. Gerrish remarked that there was a running stream half way on the road. The Bench imposed a fine of 10s. and costs.

Preventing a Meter from Registering.

At Keighley, last Friday week, an insurance agent, named Stoney, was summoned by the Haworth District Council for fraudulently preventing a meter from registering gas. The method adopted was the usual one in such cases—the disconnection of the meter and the use in its place of an india-rubber tube. It was stated on behalf of the defendant (who pleaded guilty) that he had taken temporarily the office where the irregularity occurred, and had a gas-stove there. As this had fired-back, he had tried, by means of the arrangement explained, to obtain a better pressure in order to test the stove. The Council intimated that they had no wish to press the case; and the Bench imposed a fine of 20s. and costs.

MISCELLANEOUS NEWS.

GAS WORKERS IN THE UNITED KINGDOM.

The recent publication of the occupational results of the census in Scotland enable us now to give the total number of persons engaged in connection with gas-works in the United Kingdom at the time of taking the census in 1901. The totals are as follows :—

England and Wales	47,031 (including 3 females)
Scotland	5,590 (including 5 females)
Ireland	1,489
Total	54,110

Of the total number in England, 6731 were between the ages of 10 and 25 ; in Scotland the number was 768; and in Ireland, 136. The following are the figures for the ages between 25 and 65 inclusive :—

	25	*35*	*45*	*55*	*65*
England and Wales .	13,689	12,906	8,306	4,132	1,148
Scotland	1,591	1,332	969	670	260
Ireland	182	818	—	336	47
Totals . . .	15,462	15,056	9,275	5,138	1,455

The figures for Ireland placed under the age of 55 are for the preceding 20 years. In England there were 119 persons between 65 and 75 years of age engaged in connection with gas-works at the time the census was taken.

COST OF GAS AND ELECTRICITY.

The Gaslight and Coke Company are continuing to combat erroneous statements regarding the relative cost of gas and electricity, as is seen by the circular which their meter readers in the Borough of Islington are leaving on their visit to consumers. The circulars are enclosed in envelopes "With the Compliments of the Gaslight and Coke Company," which is a little act likely to ensure for the circular the consideration of those into whose hands it is placed. The circular is as follows .—

GAS *v.* ELECTRICITY.

In view of misleading statements recently made in the Local Press as to the relative cost of gas and electricity (the Chairman of the Lighting Committee of the Islington Borough Council having been reported as stating tha "light for light, electricity was far cheaper than gas"), the Gaslight and Coke Company desire to call the attention of their consumers to the following facts, which they are prepared to substantiate, and which are being constantly confirmed by consumers who, having tried electricity, are willing to pay the Company considerable sums of money to re-instal gas lighting.

GAS LIGHT : A consumption of 150 cubic feet of gas gives a light equal to 2560 candles, at a cost (including mantle renewals at the Company's rate of charge) of . . . . . 6d.

ELECTRIC LIGHT : A consumption of 10 units of electricity gives a light equal to 2560 candles (see Whitaker's Almanack—"Electrical Measures"), at a cost (taking electricity at 4d. per unit, and allowing nothing for renewal of lamps) of . . . . . .3s. 4d.

In practice, the user of incandescent gas-light generally provides himself with *twice the volume of light* at rather less than *one-third of the cost* as compared with the light obtained by, and the cost to the user of, electric light.

Warning—The business man who uses electric light is, in the matter of working expense, at a serious disadvantage when he is in competition with one who uses gas.

INCANDESCENT GAS LIGHTING IN MARYLEBONE.

At the Meeting of the Marylebone Borough Council on Thursday, the Lighting Committee reported having received a letter from the United Kingdom Lighting Trust, Limited, with regard to their previous application for an increase of the allowance made to them for lighting Portland Place, and stating that the amount they require for lighting that thoroughfare would be £450 per annum, subject to their having an order for a further 18 lamps in the immediate vicinity, which they would agree to light at the same rate of payment—£675 per annum. Directions were given that notice should be sent to the Trust to remove the Kitson lamps and columns fixed in Portland Place, in accordance with the terms of their agreement with the Council.

The same Committee reported having considered a letter from the Gaslight and Coke Company with regard to the experimental lighting of Harley Street and Devonshire Street with incandescent gas-burners, stating that these lanterns had been fitted up by the Company without any expense to the Council, nor had any charge been made for the maintenance of the mantles, rods, and chimneys, or the upkeep of the burners, during the 21 months they had been in use, and that, as the Council had now decided upon furnishing all their street-lamps with incandescent burners and the necessary lanterns, they presumed the Council would be prepared to take over the 53 lamps fixed in these streets at cost price—£104—and to agree to the Company's usual charge for the maintenance of mantles and repairs being made in respect of them as from the commencement of the current quarter. It was resolved to inform the Company that the Council had entered into a contract with Messrs. Pontifex and Co. for the lighting of the whole of the streets of the borough on the incandescent gas system, and that the Company had better refer to the firm mentioned the question raised as to the lamps.

Several complaints of insufficient lighting were received from ratepayers ; and the Town Clerk was directed to reply that the Council had entered into a contract for the adoption of the incandescent system of gas lighting throughout the streets of the borough, and that the Contractors would shortly commence the work.

GAS AFFAIRS AT LOUGHBOROUGH.

Rising Profits—The Twelve-Hour Shift.

In moving the adoption of the Gas Committee's report at last week's meeting of the Loughborough Town Council, the Chairman (Alderman Bumpus) said that the revenue account of the undertaking for the half year to Sept. 29 showed a profit on the working of £1521, which was an increase of £572 as compared with the corresponding half of last year. This showed a very satisfactory tendency to improve, particularly in view of the fact that during this half year a reduction of 2d. per 1000 cubic feet had come into operation. It was interesting to note that the consumption of gas showed very little tendency to advance; and but for the increasing number of slot meters and the extended use of gas for cooking, there would have been a decrease of consumption as compared with last year. This was due to the slackness of trade, and also to the extended employment of incandescent mantles. It might be asked where the profits came from under these circumstances; and the explanation was that they had made a little more gas, and considerably reduced the cost of production. This was in a large measure due to the water-gas plant, which had not only produced gas at less cost per 1000 cubic feet, but had enabled them to turn out coal gas at a lower figure. This was because they produced water gas of a high illuminating power, which enabled them to use less expensive material for the production of coal gas. By combining the two systems they kept up the standard of illumination, and, in fact, improved it, while considerably reducing the cost of production. In addition to this, they had a watchful management on the part of the Manager and his staff ; and he was glad to be able to repeat his former testimony to the zeal with which Mr. Onions conducted the works.

The report having been adopted, Mr. Morley proposed that as from the 1st prox. the gas stokers should work an eight-hour shift. He said that in his opinion the hours of labour of the stokers were not satisfactory. He did not know any works of this character where men were occupied in twelve-hour shifts as at Loughborough. In the gas-works of neighbouring towns, the eight-hour shift was in operation. Three eight-hour shifts were found more economical than two of twelve hours. It was a stigma on the Corporation that their men should be compelled to work 84 hours a week. He knew the men had an opportunity of getting the eight-hour shift last January ; and he regretted they did not avail themselves of it. The majority of the men were in favour of the change ; but by some means or other they were prevented from obtaining it. Alderman Bumpus remarked that he could not support the motion. No request for a change had come from the men, who he believed were satisfied. The position was this: A given weight of coal had to be carbonized ; and the question was whether it should be done in eight hours or spread out over twelve hours. The Committee had no strong preference either way ; and on the last occasion it was resolved that the Manager should consult with the men, and arrange the shifts accordingly. The men expressed a preference for the twelve-hour shift, on the ground, he understood, that some, being elderly men, would be disqualified if they had to do the work in eight hours. The men were not working continuously—in fact, for only about seven hours altogether out of the twelve. The motion was lost by two votes to thirteen.

ABERDEEN GAS SUPPLY.

The Charge for Gas to Prepayment Consumers.

At a recent Meeting of the Gas Committee of the Aberdeen Corporation, the following report made by the Gas Engineer (Mr. Samuel Milne), on the question of reducing the cost of gas to the users of prepayment meters, was under consideration : In accordance with your remit to me, to report upon the charge made for gas consumed by prepayment meters, I beg to submit the following particulars : Prepayment meters were introduced in December, 1899 ; and in December, 1900, the number in use was 3096 ; 1901, 4143 ; 1902, 4848. At the present time there are 5413 in use, and there continues to be a steady demand for them. I have compared the actual costs of time and materials expended in connecting, exchanging, removing, and delivering ordinary meters with the corresponding expenses connected with prepayment meters for the year ending July 31 last. I have also compared the actual costs of collecting and inspecting the two classes of meters, making allowance for interest and depreciation upon the extra capital expenditure involved in prepayment meters over ordinary meters of the same capacity. The extra cost under these four heads per 1000 cubic feet of gas sold works out as follows : (1) Connecting, exchanging, removing, and delivering meters, 0·563d. ; (2) collecting and inspecting, 1·236d. ; (3) interest on extra cost of prepayment meters—£5406 at 3¼ per cent.—1·242d. ; (4) depreciation on coin mechanism at 10 per cent, 3·811d. ; total, 6·852d. The charge for gas to ordinary consumers during the past five years has been 3s. 1d., 3s., 3s. 2d., 3s. 2d., and 3s. respectively, or an average of 3s. 1d. per 1000 cubic feet ; and the charge for the current year is 3s. I estimate the cost of altering the mechanism of the present number of prepayment meters at £200, which sum should be borne by consumers using these meters. This amount, spread over a period of five years, would represent a further extra cost of 0·282d., and should be added to the above 6·852d. ; making 7·134d. per 1000 cubic feet. While this figure would meet the working expenses, interest, and depreciation on the extra capital involved, there is another consideration which has a most important bearing on the matter, and that is the effect that a liberal reduction on the present charge for gas consumed through prepayment meters would have upon the other existing meter

plant. In my opinion, it would have the effect of a greatly increased demand for prepayment meters on the part of those who are presently using ordinary wet meters; for constant applications are being made for dry meters in lieu of wet, and if consumers fail to obtain an exchange from wet to dry, they would readily apply for prepayment meters if a liberal reduction was made on the price. The stock of wet meters, which comprises 55 per cent. of the total, and are perfectly good and valued at £18,000, would become obsolete, and in the course of a few years be reduced to £1000 value as scrap metal. Depreciation would have to be written off annually for this; and it could only be at the expense of the ordinary consumers, unless provision were made to include it in the prepayment charge, which would appear to be fair, seeing that it would be caused by the substitution of prepayment meters. In order to express this depreciation in pence per 1000 cubic feet of gas sold, I have assumed that 1000 wet meters per annum, valued at £1000, would be rendered valueless, due to the substitution of an equal number of prepayment meters, and that the average consumption of gas per prepayment meter would continue as last year. On this basis, I find that the average rate of depreciation would, for the next five years, amount to 4·557d. per 1000 cubic feet. The present charge for gas sold by prepayment meters is at the rate of 20 cubic feet for a penny, or 4s. 2d. per 1000 cubic feet; 21 feet for a penny is equivalent to 3s. 11·61d. per 1000 cubic feet; 22 feet for a penny is equivalent to 3s. 9·45d. per 1000; 23 feet for a penny is equivalent to 3s. 7·47d. per 1000; 24 feet for a penny is equivalent to 3s. 5·66d. per 1000; 25 feet for a penny is equivalent to 3s. 4d. per 1000. It would therefore appear that the present price is, as near as possible, the correct one, having regard to the interests of the general consumers.

A long discussion ensued on the report; and it was ultimately decided to defer consideration of the matter in the meantime.

THE MARYLEBONE ELECTRIC LIGHTING MUDDLE.

At the Meeting of the Marylebone Borough Council on Thursday—the MAYOR (the Rev. H. Russell Wakefield) presiding—the question of the steps to be taken by the Council in connection with the purchase of the portion of the works of the Metropolitan Electric Supply Company within the borough gave rise to a long discussion.

The TOWN CLERK (Mr. J. Wilson) reported that a petition, numerously signed, had been received on the subject, and that an influential deputation was present to support it. It was as follows:—

We, the undersigned ratepayers of Marylebone, invite you to consider our views on the electric light scheme into which the Borough Council have entered. As we understand the matter, the Council contemplate paying to the Metropolitan Electric Supply Company £1,212,000, of which sum about £1,000,000, according to the estimate of the Chairman of the Electric Lighting Committee, may be considered as represented by the goodwill of the business; and as further sums will be required for land, a generating station, and other additions, the total cost of the undertaking may reach about £2,000,000. We are convinced that the purchase of the Electric Supply Company's undertaking would result in a heavy loss to the borough, if only from the fact that since your expert's figures of profit were originally prepared, the rate at which the Council could borrow the necessary capital has greatly increased; and it is clear from Professor Kennedy's report that this increase will swallow up all the profits originally calculated by your expert. In addition to this, there seems now to be less likelihood that Parliament would consent to its repayment over as long a period as 42 years. We venture to question the propriety of entering on an industrial undertaking of this magnitude without first consulting the ratepayers at a meeting summoned specially for the purpose; and this feeling is intensified when we observe that it is necessary to invest so large an amount of the ratepayers' money in such a speculative asset as the estimated future profits of a concern which has only a life of 27 years, at the end of which time it can be purchased without any payment for goodwill. We trust, however, that this proposal will not be forced upon us; and in lieu thereof we venture to suggest that the Council should endeavour to come to an understanding with the Company to relieve the borough from the present arrangement.

The deputation having been introduced,

The Hon. H. C. GIBBS, addressing the Council, said that there were 23,000 voters in Marylebone, and they had approached about three-fifths of the number, from whom they had obtained many signatures—909 having been lodged that day. It was their opinion that in the hands of the Council the electric lighting undertaking would not be worth the money paid for it; for they would be buying a certain amount of plant, estimated to be worth £88,000 to the Company and nothing to the borough. If they bought the goodwill of an undertaking the value of which depended upon an expected increase in the borough, it became a speculation; and a speculation was not in the province of the Council. It was unjust to throw a risk of loss upon the poorer ratepayers who did not use the light. They held that before any local authority went into such an undertaking, the ratepayers should be consulted; and this had not been done. When the petitioners asked the Council to endeavour to compromise, they asked that they should try to agree with the Company to annul the contract and the award, and go back to the *status quo ante*. He had received a letter from the Manager to the Company in answer to one he had sent to the Chairman, in which the latter declined to be met, because the matter was before the High Court. The Manager went on to say that the Chairman had no doubt that his Board would be ready to consider in a friendly spirit any proposal the Council might wish to lay before them. What was the position of the Council? They had not the money to pay the amount of the award, to start with; and there was a determination on the part of the ratepayers to throw over the Bill when put before them. The ratepayers and the Council, the speaker contended, were two separate entities; and, in his opinion, it would be proved that the former would not give their sanction to this scheme. He earnestly begged the Council favourably to consider their petition.

Prebendary BARKER said the petitioners did not come there with any recriminatory language to blame any one, but with a plea that the Council should approach the Company to ascertain whether they could be relieved from this burdensome undertaking. If terms could not be obtained, they would not be in a worse position than they were in at present. No one would dispute that it was a bad bargain, and, as wise men, they should try either to amend or to get out of it.

After some questions had been put and replied to,

The MAYOR said the Council welcomed the deputation, and were glad to see that interest in the electric lighting question had been aroused in quarters where stimulus was required.

The deputation thanked his Worship and withdrew.

Mr. E. R. DEBENHAM, the Chairman of the Electricity Committee, then moved to affix the seal of the Council to the petition to Parliament for leave to introduce the St. Marylebone Electric Lighting Bill; and, on a division, the motion was carried by 41 votes to 17.

Mr. E. WHITE then moved that a Committee, consisting of the Mayor, Mr. J. Watson, and himself, be appointed to confer with the Metropolitan Electric Supply Company with a view to an arrangement being arrived at to remove the present deadlock.

Dr. ROTHEROE seconded the motion.

Colonel HOPKINS moved, and Mr. SIEVEKING seconded, the following amendment: "That a Committee, consisting of the Mayor, the ex-Mayor, and the Chairman of the Electricity Committee, be appointed to confer with the Metropolitan Electric Supply Company, with a view to ascertain if any arrangement can be made to remove the present deadlock."

This was agreed to, but was vetoed in favour of the following amendment, which was carried as the substantive resolution: "That a Committee, consisting of the Mayor, the ex-Mayor, and the Chairman of the Electricity Committee, be appointed to confer with the Metropolitan Electric Supply Company, and to report to the Council the terms and conditions on which it will agree to set aside the award."

Other motions in connection with the electric lighting question were deferred to the meeting of the Council in January.

In the Chancery Division of the High Court of Justice on Friday, application was made to Mr. Justice Buckley by Mr. Buckmaster, K.C., representing the Borough Council, for an extension of time in which to pay the purchase-money for the undertaking from the 31st inst. to the 30th of June next. His Lordship granted an extension to the 29th of February, by which time, he said, it would be definitely known whether or not the ratepayers approved of the Bill the Council had promoted. The extension was granted on condition that the Council should repay to the Electric Supply Company, within a short time, a sum of £60,000 in repect of capital expenditure by them upon the undertaking, which would require the levying of a rate of 9d. in the pound. Certain other terms were imposed by his Lordship; and the Council were ordered to pay the costs of the application.

WILLESDEN ELECTRICITY WORKS TO BE SOLD.

Last Tuesday, the Willesden District Council had under consideration the subject of the proposed sale of their electricity works to the North Metropolitan Electricity Supply Company. The Electricity Committee reported as follows: "The draft agreement for sale of the electricity works in Taylor's Lane to the North Metropolitan Electric Power Supply Company having been carefully considered, your Committee recommend that such agreement be approved, subject to such alterations as the Solicitor and Electrical Engineer have already made or may consider necessary for protecting the interests of the Council, and subject to the insertion of a clause enabling the Council to require payment at any time in cash of any balance which may be due from the Company, on giving six months' notice to that effect."

The Chairman of the Committee (Mr. Pinkham, J.P.), in moving the adoption of the recommendation that the agreement be approved, said the Council were simply selling some bricks and mortar, constituting what was called a generating station, to a Company who could supply electricity at such a price as the Council could not produce it at. They were asked why, if the Company could make it pay, the Council could not do the same. The Company was a large concern, possessing three or four big businesses, and could therefore supply cheaper than the Council, who had only one undertaking. If Willesden had retained its tramways, no company would ever have put their nose into the district. The Council were safeguarded and guaranteed in every way. It was not at all a similar case to that of Marylebone. Mr. Carter moved that the matter be referred back to the Committee, to take the opinion of Professor Kennedy or some other leading expert. This, however, was negatived by ten votes to five. A further amendment was then moved, to the effect that the purchase price to be received by the Council on behalf of the ratepayers was inadequate, and that the agreement should be referred back for further consideration. But the voting on this was the same as before. A third amendment was introduced by Mr. Davies—"That it is expedient that the draft agreements between the Council and the North Metropolitan Electric Power Supply Company (drawn by the latter) be published, and that the seal of the Council shall not be attached to same until after the election in April next, to enable the ratepayers to have an opportunity of expressing their approval, as a Special Act of Parliament was promoted by the said Company to enable them to buy the generating station (with but very few of the ratepayers' knowledge), besides which the Council have no mandate from the ratepayers to part with their undertaking." Mr. Davies remarked that the British Electric Traction Company, of whose history he knew something, were behind this deal. The little Company were only a mask. He failed, however, as had the other movers of amendments, to carry the meeting with him; and the recommendation of the Committee was adopted.

Gas-Meter Testing in London.—During the year ending the 31st of March last, the number of meters tested by the officials of the London County Council at their four testing-offices—situated in Westminster, Clerkenwell, Spitalfields, and Newington—was 186,198, compared with 181,250 in the preceding twelve months. The fees in respect of the former amounted to £5842; of the latter, to £5840.

THE LIGHTING OF DEVONPORT.

The question of the substitution of incandescent gas lighting for the present flat-flame system was under consideration at a meeting of the Devonport Town Council on Thursday. Mr. E. M. Leest had given notice of a resolution instructing the Surveyor's Committee to proceed with the re-lighting with double incandescent burners, and to carry out the work at the rate of two wards in every six months. As there are fourteen wards in the borough, this would spread the work over three or four years. There are now 980 lamps, of which 220 are fitted with incandescent burners. The cost of conversion is put at 10s. 6d. per lamp; and the Gas Committee receive 5s. per lamp per annum for mantles, &c. Mr. Leest said that the lighting of the whole borough needed to be improved; and the back lanes as well as the main streets should be lighted. The cost of the conversion of 760 lamps to incandescent lighting would not be more than £500; and he proposed to substitute for the resolution of which he had given notice one empowering the Committee to apply to the Local Government Board for a loan for the purpose. Alderman Littleton seconded the resolution, and said he hoped the Committee would be instructed to get on with the work as fast as possible. Mr. W. Hornbrook said it was not merely a question of fitting incandescent burners or even of new lanterns. It had been discovered that the mains were rotten throughout the borough, and it would be necessary to renew the pipes in many instances. When they opened up the ground, they found in a number of cases that they could put their fingers through the mains. Still, he thought the Corporation made a cheap bargain in the purchase of the gas undertaking. He could not say when the conversion would be made; but, as far as the Gas Committee were concerned, they would not keep the borough waiting a day unnecessarily. Mr. George moved, and Mr. Love seconded, that the question be referred to the Lighting Committee to bring up a report as to the relative cost of incandescent gas and electric lighting. Mr. Short said that Liverpool gave a trial to electric lighting on a large scale, and then returned to incandescent gas, as being more effective and economical. The amendment was accepted by Mr. Leest, and carried unanimously.

GRAND JUNCTION WATER-WORKS COMPANY.

The Half-Yearly General Meeting was held at the Offices, South Molton Street, last Wednesday—Mr. FREDERICK TENDRON, F.G.S., presiding.

The SECRETARY (Mr. J. Goodwin) read the notice calling the meeting; and some formal business was afterwards disposed of.

The CHAIRMAN, having referred with regret to the absence of his colleagues, Mr. Harrison and Mr. Horsley, through indisposition, and of Mr. Tagart, proceeded to move the adoption of the report and accounts. The proprietors, he said, had no doubt noticed the paragraph at the foot of the accounts signed by the Government Auditor. They might remember the remarks he made at the last meeting on the subject, when he stated that, whatever views Mr. Stoneham might hold, there was no reason why he should leave the accounts unsigned, and that he might sign them while expressing his views in his certificate. Mr. Stoneham had been good enough to fall in with that view, and to affix his signature to the present accounts accompanied by his remarks. Since then, the matter had come before the Court of Arbitration, whose decision was that the water in the Staines reservoirs had not been obtained by the Companies within the meaning of the clause. Thus there was an end of this matter. Mr. Stoneham also contended that the Board had no right to put down the claim which the Company had to make for the interest they had been paying for a number of years on the debenture stock that was raised for paying for the works of these reservoirs. The Directors, on the contrary, held that they were quite right in setting out this claim, and treating it as a matter of suspense, to be decided upon by the same Court. The amount up to Sept. 30 last was £51,549. Referring to the ordinary business of the Company, he said that it must be satisfactory to the proprietors to see that the supplies were constantly increasing. During the half year, no fewer than 1729 fresh supplies were put on, compared with 1428 in the corresponding period of the previous year. The rental, too, showed a most satisfactory increase for the half year, having amounted to £123,681, or an increase of £4751 over that of the September half of 1902. The profit for the year ended September last was £119,866, compared with £117,510 for the previous year; and the amount available for the maximum 10 per cent. shares for the two years was £87,316 this year, against £84,960 for the previous year. The amount required to pay a dividend of 10 per cent. was £84,600; and therefore the Company practically earned last year a trifle over 10 per cent., and this year 10·33 per cent. All these figures were very satisfactory; and when, in addition, it was seen that they had an undivided balance of £21,792, which was considerably in excess of the amount they would have to pay during the next nine months for interest on the Staines works, he thought their financial position was exceedingly strong. He wished, however, the proprietors to understand clearly that in the figures he had mentioned there had been no deduction for the amounts paid by the Company on account of Staines; the Board considering that these were matters which were entirely within the province of the Court of Arbitration. The capital expenditure had exceeded the capital raised by £23,156; and sooner or later this amount would have to be provided out of the additional capital they had the power to raise. They had authority to raise up to the value of £100,000 in 3 per cent. debenture stock, of which the Directors would issue as much as was necessary to adjust the account and to meet any capital expenditure which might be incurred during the next nine months. Unfortunately, in one sense—even if it were only for nine months—this capital was sterilized; in other words, although there might be a very good profit on the outlay of a few thousand pounds, yet the Company were to derive no advantage from it—the expenditure was to be for the good of the public. His own view, however, was that Parliament had never intended to take away privileges and profits which it had previously conceded. The Directors had entered into an arrangement with the Secretary, who had served them for so many years, both with respect to his pension and his services during the time of the liquidation of the Company. It was agreed that his retiring pension should be at the rate of £700 a year; and he was to receive, as additional compensation for his services to the end of the liquidation, the difference between the amount of £700 a year and his salary. This would make £1000 a year. The Board fully recognized that Mr. Goodwin's services were worth more, and also that he had rendered certain professional services which must be remunerated. If the special remuneration which the Directors considered proper in the matter were provided for in the costs allowed to the Company out of the arbitration, the Board would not have to ask the proprietors for any gratuity; but if special provision were not made, they would unhesitatingly ask to be supported in the judgment they would then pronounce as to the special compensation they desired to offer to two or three of the officers—especially to Mr. Bonnor-Maurice—for their great services and devotion to the Company's interests at all times, and in working night and day on the arbitration business. He had been strongly cautioned that it would be neither right nor proper for him to express any opinion or to make any remarks on the case now before the Court of Arbitration.

Viscount KNUTSFORD, G.C.M.G., seconded the motion.

Mr. WHITWORTH said it would be a matter of very considerable difficulty to allot in an equitable manner the funds which might be awarded to the Company. He had the greatest confidence in the Directors' impartiality; but he felt that the 7 per cent. shareholders should have an opportunity before the Board announced their decision of stating their case.

The CHAIRMAN, in reply, said that the Directors would do absolutely what was fair between one class of proprietors and another; and if the Board had the slightest doubt, they would ask representatives of the different classes to meet them. It would, however, be most impolitic at a public meeting to discuss their respective claims. The different interests were well represented on the Board, who would ask for advice in the event of a shadow of difficulty arising.

Mr. REMNANT, M.P., said he desired to state on behalf of the shareholders present—or the very great majority of them—that they had the most absolute confidence in the Board.

Mr. A. H. BAKER endorsed the remarks of the previous speaker, and desired to thank the Directors for the way in which they had piloted the Company in all the anxieties and troubles against which they had had to contend for so many years.

The resolution was unanimously adopted; and dividends were afterwards declared at the rate of 10 per cent. per annum on the "A" and "B" shares, 7½ per cent. per annum on the "C" shares, and 7 per cent. per annum on the "D" shares.

Mr. REMNANT then proposed, and Mr. SPICER seconded, the following resolution, which was unanimously carried—"That this meeting confirm and approve the agreement dated Dec. 2, 1903, with the Secretary, providing for his retirement and pension, and for the payment of his services up to the dissolution of the Company."

The SECRETARY, in reply, expressed his warm thanks for the resolution, and stated that, after the transfer of the undertaking to the Water Board, he would do his utmost to assist the Directors in bringing the Company's affairs to a satisfactory termination.

Mr. DREW inquired if anything was going to be done for the staff.

The CHAIRMAN replied that the staff would all be taken over on the conditions laid down in the Metropolis Water Act.

Mr. SPICER asked whether the shareholders were to be paid off in cash or in what way.

The CHAIRMAN stated that they would have the choice of cash; they would have cash if they did not take stock. The Water Board were not bound to give stock; but they might realize that it would be very difficult to place so large an amount of stock, and they might find it advantageous to suggest to the Directors that those shareholders who wished to do so could have stock. The matter was quite optional. It was the Water Board's own desire to make it so; but perhaps now they were a little sorry for having put it in this way.

An Extraordinary General Meeting was held subsequently, and

The CHAIRMAN proposed the following resolution—"That the debenture stock authorized by the Grand Junction Water-Works Act, 1902, be, in exercise of the powers conferred on the Company by that Act, hereby created, and that the stock thus created be issued and disposed of by the Directors in such proportions, with such rights and privileges, on such terms and conditions, at such time, and in such manner, consistent with the provisions of the said Act, as may by the Directors be deemed expedient from time to time."

Viscount KNUTSFORD seconded the motion.

The CHAIRMAN, in answer to Mr. Spicer, stated that the Directors had not decided anything as to the amount of stock that was to be issued; but it would not be more than was needed.

Mr. BAKER afterwards proposed a cordial vote of thanks to the Chairman and Directors.

Mr. WHITWORTH seconded the resolution, which was carried unanimously.

The CHAIRMAN briefly acknowledged the vote; and the proceedings then terminated.

Quality of Nottingham Gas.—Some amusement was caused at the last meeting of the Nottingham City Council, when Mr. Gregg asked the Chairman of the Gas Committee how long he was going to supply the "villainous stuff called gas." He wanted to know whether, when the price was reduced 3d. per 1000 cubic feet, the illuminating power was not also reduced from 18 to 15 candles, which made the gas 4d. per 1000 feet cheaper to the Committee; and whether it would not be better to reduce the quality in the springtime, when people could get into the open air. Alderman Ford said there had been some difficulty with regard to the fittings. As to the illuminating power, this had been reduced some time since; but it was now 17½ candles, and he thought in future that Mr. Gregg would have no complaint to make.

METROPOLITAN WATER ARBITRATION.

(*Before the Right Hon. Sir* EDWARD FRY, *Sir* HUGH OWEN, G.C.B., *and Sir* JOHN WOLFE-BARRY, K.C.B.)

Opening of the Grand Junction Company's Case.

Twenty-Fourth Day.—Thursday, Dec. 3.

As announced last week, at the conclusion of the proceedings in the New River case, the Court proceeded to consider the case of the Grand Junction Company. Their claim is for some £4,863,000; the offer of the Water Board being £1,500,000.

Mr. BALFOUR BROWNE, in opening for the Company, said that, comparing this with the last two cases, it was a comparatively simple one; but there were, of course, certain of the issues raised in the last case that affected this Company. As to the history of the Company, in 1798 the Grand Junction Canal Company were authorized to lay pipes and supply water to the inhabitants of the parish of Paddington and places adjacent. By an Act passed in 1811, these powers were transferred to a separate body—a new undertaking called the Grand Junction Water Company. The original works were started at Paddington; and they took water from the Grand Junction Canal for the supply of the district until the year 1826, when the source of supply was removed from the Grand Junction Canal to the River Thames at Chelsea. In 1835, this source of supply was abandoned and a new one established a short distance above Kew Bridge. This was superseded by an Act in 1852; and the Company's source of supply was then removed to its present position at Hampton. By several Acts, the Company had been authorized to raise capital and to extend their area of supply; and in the year 1896 they joined with the New River and West Middlesex Companies in promoting a Bill for the construction of the Staines reservoirs. Counsel went on to describe the districts and the supply works, included in which was a reservoir at Ealing containing about 50 million gallons of water. They were at present supplying a very large amount of water in their district; but not nearly so large a quantity as they would if they found customers for it. Up to the present time, they had not nearly reached the amount that they could take from the River Thames, which was 24½ million gallons a day. They had no sinking fund put upon them until the Act of 1902, which was only a Money Act. They had no sterilization clause until then; and they had never exercised any powers of the Act up to the present time. It was possible, however, that they would, because they had overdrawn their banking account; it was possible to put themselves right, and to raise certain moneys. The statutory area of supply was 52½ square miles; the area at present supplied was 43 square miles 472½ acres. The population was estimated this year at 472,000; and the daily supply per head was 36·8 gallons. He did not think that the quality of the water could be seriously questioned; and with regard to the nature of their works, nobody would say that they were not in first-rate condition. Then the question was, What was their income? Was it maintainable? And was there a future before the Company? He would show that the income had grown rapidly, and that it would grow very rapidly in the next few years. They were not very near the end of their tether so far as the sources of supply were concerned. Therefore he said that they would have had a very good future if they had been left alone; and when this future was taken from them, they claimed upon the basis of what they might and would have earned. Counsel proceeded to deal with the figures upon which the claim was founded, indicating from printed tables the amount of water supply, population, capital expenditure, revenue, and profits for the ten years ending Sept. 30, 1903. There was a maximum dividend to-day paid and payable. They claimed their maximum statutory dividend capitalized upon a basis of excellent security; and, further, for the arrears of dividends discounted down to their present value. There was a maximum dividend of £117,150 multiplied by 36·36 years' purchase, £4,260,000; the amount paid in respect of the Staines reservoirs to Sept. 30, 1903, with interest, £55,540; estimated surplus profits to June 24, 1904, available for back-dividends, £26,715; and other items brought up the claim to £4,863,195.

Twenty-Fifth Day—Friday, Dec. 4.

Mr. *Walter Hunter*, examined by Mr. BOYLE, enumerated the districts supplied by the Company. Supplies were made by other Companies within the Company's statutory area at Chelsea and Paddington. The area of the statutory supply was about 52½ square miles, and the actual supply 44 square miles 495½ acres. The population in the county of London supplied at the end of 1902 was about 264,688, and in Middlesex about 202,046—making a total of 466,734. Witness proceeded to describe the position of lands belonging to the Company not used in their business at the present time, and alluded to certain purchases.

Mr. BALFOUR BROWNE: I think we might shorten this. We are not making any claim in respect of these lands. They are part of the undertaking.

The PRESIDENT (to witness): Do you consider the works at Hampton adequate to the supply that is demanded?

Witness: More than adequate. Owing to the circumstances we describe, they are adequate for many years to come, and in good working condition in all respects.

Examination continued: The filters were very much more than were required, and the pumping machinery also. As to the capacity of the works, about 6½ acres of filters at Hampton were originally constructed as rough preliminary filters, and the water was filtered a second time at the Kew Bridge works. These had since been converted into filters of best modern construction. The supply available from Kew Bridge was 28 million gallons daily; from Hampton, for the country district, 10 millions—a total of 38 millions, against 17,150,000 gallons, which it appeared they were supplying. They had more than enough as regarded pumping and filtering. There was a large storage reservoir at Ealing, which could contain 50 million gallons of filtered water. The works there were in very good order indeed. The Campden Hill works were used for delivering high-pressure water into town. They covered an area of about 5 acres, and were in very good order, as were also the reservoirs there.

Mr. BOYLE: Your present pumping plant is sufficient for 28 years, and your filters for 40?

Witness: That is so.

Continuing, witness said all their water was supplied on the constant system. The number of supplies on Sept. 30, 1902, was 71,372, and on Sept. 30, 1903, 74,478. The estimated population within the Company's district was 462,491 on Sept. 30, 1902, and 482,617 on Sept. 30, 1903. The number of miles of water-pipe in the district constantly charged was 196 within the Metropolis; the total was 495 miles in September, 1902, and 511 miles last September. The domestic supply for the year ending Sept. 30, 1902, amounted to 5,492,591,520 gallons; the metered supply, 1,385,785,000 gallons—being about 20 per cent. The total supply was 6,876,349,520 gallons. The average daily supply during the year ended Dec. 31, 1902, was 18,421,880 gallons, which worked out at 40·2 gallons per head per day. In the year from Nov. 1, 1902, to Oct. 31, 1903, the average daily supply had been 17,219,657 gallons, with a population of 474,142, or an average of 36·4 gallons per head per day. Table A showed that there was now a very much lower supply per head than it had been for ten years. Attention had been given during the last two or three years to the special subject of supply and waste. Large reductions in waste had been made—the saving amounting to about 1,200,000 gallons a day in the town district, and over 1,000,000 gallons in the country. The Company largely supplied a residential population; there were no manufactures in the district. In the Metropolitan area, they looked for an increased revenue from new and improved houses erected on the sites of old buildings which were constantly being pulled down. The future increase in the Company's supplies would take place mainly in the suburban portions of Middlesex. The increase in the number of supplies in past years had been at the rate of about 1000 per annum; and in more recent years, up to last year, at the rate of about 2000 per annum. The estimated average daily supply required in 1910 would be 19,331,565 gallons, which could be furnished without having recourse to storage. The storage possessed by the Company was: Unfiltered water, 58,500,000 gallons; filtered water, 75,000,000 gallons—a total of 133,500,000 gallons. Deducting 10 per cent. from this, left the available storage of 120 million gallons. This was sufficient to supply a daily average of about 21·5 million gallons, based upon the year 1899—which was the worst year they could discover; and this allowed for the maximum of 26·2 million gallons a day in the summer, generally July. In his view, the Company had sufficient water until 1914 without any recourse whatever to storage. With the exception of some gravel beds at Sunbury, they obtained all their water from the Thames. In reply to further questions, witness said the works and mains were kept in first-class order out of revenue. All renewals were charged to revenue.

In cross-examination by Mr. MOULTON, witness said he had given evidence before a Committee of the House of Commons as to the Staines reservoirs. He had said he thought the reservoirs were necessary to supply the wants of their district and for purposes of storage. He had stated before the Committee that the first flood of water was liable to be polluted, and it was desirable not to use this; but he thought people had changed their views on this matter since.

Mr. MOULTON: You will admit that, having to take the water from the river when in bad condition, the supply distributed to consumers is liable to be of bad quality.

Witness: That depends entirely, in my opinion, upon whether the sand is fine enough and the water is filtered slowly. You may take it that Sir William Crookes and Professor Dewar do not object to our taking in flood water.

Do you agree that it would be a great advantage to the supply that you should have the storage available when the floods are on?—It is a great advantage to the supply to have either storage or a very large filtration area. In this case, we have extensive filtration area; and therefore, in my opinion, storage for this purpose is not required.

In further cross-examination, witness said they did not commence to lower the consumption on a proper basis until this year, when a waste department was instituted. It was found that they had reduced the waste considerably. He denied that a sudden spurt had been made in view of the purchase of their undertaking. They had taken steps to reduce the waste in every possible way.

The further cross-examination of witness was postponed, as was also his re-examination.

Mr. *S. Wood*, examined by Mr. BALFOUR BROWNE, gave evidence upon the Company's tables of figures, which had been drawn up under his superintendence, dealing with supply, population, capital expenditure, revenue, profits, &c. The maximum dividend of £117,150, multiplied by 36·36 years' purchase, made up £4,260,000; the amount paid in respect of the Staines reservoirs to Sept. 30, 1903, with interest, was £55,540; and the estimated surplus profits to June 24, 1904, available for back-dividends, was £26,715. The arrears of dividend amounted to £722,412, which the Water Board assessed at £718,879. An allowance for cost of reinvestment to cover brokerage and stamps, 1 per cent. on £4,767,839, amounted to £47,678; an allowance for recoupment of loss of interest pending investment, 1 per cent. on £4,767,839, came to the same; and there was also an item reserved for covering costs, charges, and expenses incurred and to be incurred in consequence of the passing of the Act of 1902, up to, and including, the dissolution of the Company, including costs of the arbitration under the Act. These items made the total amount of the claim—£4,863,195.

Twenty-Sixth Day—Saturday, Dec. 5.

Mr. *E. A. Bonnor-Maurice*, gave evidence in regard to the capita powers of the Company, and put in a table showing the rate of interest at which the capital had been raised, and as to the maximum dividends of each class of shares. The total amount authorized was £1,800,250, of which £115,000 mortgage capital was not issued. The total paid up

therefore was £1,685,250. O this, £310,000 was perpetual 4 per cent. debenture stock, and £75,250 redeemable 3 per cent. debenture stock—redeemable at the end of 25 years from the date of issue (1899) and not subject to the sinking-fund clauses.

Mr. *Walter Hunter*, recalled and cross-examined by Mr. MOULTON, said that depreciation was not charged because all renewals and expenses were charged against revenue. He did not think it was fair to charge the special expenditure of 1901 to that particular year.

Mr. *Daniel Hill* was then called. In reply to Mr. BOYLE, he said he had prepared the account handed to the Accountants of the Water Board, showing the net revenue for the year 1902 to be £134,278 9s. 1d., or, less interest, £12,182 4s. 10d., £122,096 4s. 3d.; but this was now claimed to be £122,669 6s. 1d. Mr. Wood and he had met the Accountants of the Water Board on several occasions, and had agreed that the figures in the account marked W.—viz., £105,081 9s. 7d.—were correct; but for the purposes of the arbitration, certain adjustments should be made in order to show fairly the result of the business in the year 1891-2. These adjustments were: Maintenance, £2000; parliamentary expenses, £2417 8s. 5d.; Staines interest, &c., paid, £12,374 12s. 6d.; interest on £23,551—one year at 3 per cent., to Sept. 30, 1902, and half year on £5948—£795 15s. 7d.; making a total of £17,587 16s. 6d., which, added to the agreed profits, amounted to £122,669 6s. 1d. On the purchase or sale of a business, it was his practice to pay special attention to the charges under the head of maintenance and repairs. The correct charge was based upon the average of seven years. With regard to property and income-tax charged in the accounts, it was frequently contended that income-tax was not a proper charge in a profit and loss account for purposes of sale; but as it was customary for the Company to pay the fees of Directors and salaries of Secretary and clerks, he thought the tax should be charged. He considered, however, that an adjustment should be claimed in addition to these amounting to £17,587. Taking the average of the past seven years, 10·25d. made a difference of £170; but possibly 9d. would be more equitable, which would make the difference about £200. In the case of the East London Company, a similar adjustment had been agreed to. Witness then handed in a table showing the steady and progressive growth of the Company's business. The net profits were: 1893, £95,902; 1894, £95,932; 1895, £96,150; 1896, £96,685; 1897, £101,499 (including Staines expenditure, £100,984); 1898, £103,415 (£101,515); 1899, £108,633 (£104,929); 1900, £110,250 (£103,324); 1901, £114,561 (£104,055); 1902, £117,642 (£105,373); and 1903, £119,991 (£104,262). The Water Board's summary showed the averages for ten years to September, 1902, as follows: Net water-rental, £207,514; net working expenses, excluding special expenditure, £96,086; trading profits, £112,137; interest paid, less received (including Staines), £16,211; net profit, including Staines expenditure, £96,787.

Sir *William Crookes* and Professor *Dewar* were called with regard to the quality of the water supplied by the Company, which they stated was excellent.

Twenty-Seventh Day—Monday, Dec. 7.

Professor *Dewar*, recalled, gave evidence with regard to the specific number of samples of water of the Grand Junction Company which he and Sir William Crookes had examined bacteriologically by the Koch method during each month of the present year.

Mr. *E. W. Rushworth*, said he had inspected the district supplied by the Company, and was acquainted with the rateable value of the property there. The increase in the rateable value in the West End—Pall Mall, Regent Street, Oxford Street, New Bond Street—during twenty years ending in 1901 was £372,205; the average yearly increase being £18,600. He believed this increase would continue. The chief cause of the increase he attributed to the pulling down of old and inferior property and rebuilding in superior style. There was also a general gradual increase going on in value, especially in the main trading thoroughfares.

Mr. *A. E. Booker* was called and produced a schedule showing the increase in rateable value of property in the Paddington and Bayswater estates. His estimated increased rateable value varied from *nil* to as much as 21 per cent.

Mr. *Charles Hawksley* was then examined by Mr. BALFOUR BROWNE. On the question of maintainable revenue, he agreed with that shown by the Company's tables.

Mr. BALFOUR BROWNE: With regard to the supply per head of the population in this district, what do you say, with proper prevention of waste, we ought to be able to reduce it to?

Witness: To 30 gallons or less per head per diem.

Is 33 gallons a safe margin?—Yes.

What percentage do you say our working expenses ought to bear to the gross receipts?—I have made careful examination of the accounts, and I make it 44½ per cent. of the net rental, to carry on and maintain the existing works in perpetuity.

On the question of storage and filtration, it is not storage to tide over a drought which they are suggesting, but storage in order that the water may part with some of its heavier materials?—Yes.

Can you produce the same effect by careful filtration that you can by subsidence combined with filtration?—Certainly not.

Are the works in excellent condition?—They are.

Mr. *Henry Rofe*, in answer to Mr. BALFOUR BROWNE, said that he had special knowledge with regard to the Nottingham water undertaking. Two or three years ago, the consumption for domestic supply was 13 or 14 gallons per head per day. When he left in 1878, it was 12 gallons. This 12 gallons was an absolutely perfect supply—everyone took all he wanted. For the district supplied by the Grand Junction Company, 33 gallons was ample. There was very little trade supply. The works were in excellent condition.

Mr. *E. K. Burstal* agreed that 33 gallons per head per day was ample for the district.

Mr. BALFOUR BROWNE said, before he absolutely closed his case, he wished to point out that the Court might take an adverse view to that of the Company with reference to the way in which the expenses

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 674.

Issue.	Share	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 15	10½	Alliance & Dublin	10 p.c.	18¾—19¼	..	5 7 8
100,000	10	,,	7½	Do.	7 p.c.	12⅞—13¼	..	5 11 1
200,000	5	Nov. 12	6⅛	Bombay, Ltd.	. . .	5½—6	..	5 8 4
140,000	5	,,	6½	Do. New, £4 paid		4—4¼	..	5 15 7
380,000	Stk.	Aug. 13	12	Brentford Consolidated		228—233	..	5 3 0
300,000	,,	,,	9	Do. New . . .		171—176	−2	5 2 3
50,000	,,	,,	5	Do. 5 p.c. Pref. .		130—135	..	3 14 1
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb. .		103—108*	..	3 14 1
220,000	Stk.	Sept. 11	10½	Brighton & Hove Orig.		207—212	..	5 1 5
246,320	,,	,,	7½	Do. A. Ord. Stk. .		145—150	..	5 3 4
460,000	20	Oct. 15	10	British.		38¼—39½	..	5 1 3
100,000	Stk.	Aug. 13	6	Bromley, Ord. 5 p.c. .		115—120	..	5 0 0
165,700	,,	,,	4½	Do. do. 3½ p.c. .		88—93	..	4 16 9
500,000	10	Oct. 15	7	Buenos Ayres (New) Ltd.		10¼—10⅝	..	6 10 3
250,000	Stk.	June 26	4	Do 4 p.c. Deb.		93—95	..	4 4 3
150,000	20	July 10	8¼	Cagliari, Ltd. . . .		22—24	..	6 17 6
100,000	10	June 11	10	Cape Town & Dis., Ltd.		14—15	..	6 13 4
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.		52—54	..	5 11 1
1,375,000	Stk.	Aug. 27	5 5/10	Commercial 4 p.c. Stk.		104—107	..	4 17 3
503,750	,,	,,	5	Do. 3½ p.c. do.		97—100	..	5 0 0
442,947	,,	Dec. 11	3	Do. 3 p.c. Deb. do.		86—89*	+½	3 7 5
800,000	Stk.	June 11	7	Continental Union, Ltd.		118—123	..	5 13 10
200,000	,,	,,	7	Do. 7 p.c. Pref.		130—135	..	5 3 8
575,000	Stk.	Aug. 27	5⅛	Crystal Palace Ord. 5 p.c.		112—117	..	4 11 1
60,000	,,	,,	5	Do. 5 p.c. Pref. .		118—123	..	4 1 4
112,533	,,	July 10	5	Do. 5 p.c. Deb. Stk.		135—138	..	3 12 6
486,090	10	July 29	10½	European, Ltd. . . .		18—19	..	5 10 6
354,060	10	,,	10⅝	Do. £7 10s. paid		13—14	..	5 12 6
15,243,200	Stk.	Aug. 13	4 1/16	Gas-light and Coke	4 p.c. Ord. . .	87—89	+1	4 18 10
					3⅜ p.c. max. .	86—88	..	3 19 7
					4 p.c. Con. Pref.	107—110	..	3 12 9
					3 p.c. Con. Deb.	85—87*	−⅛	3 9 0
2,600,000	,,	,,	3⅜	Hastings & St. L. 3½ p.c.		90—95	..	5 5 3
4,193,975	,,	Dec. 11	3	Hongkong & China, Ltd.		16—17	..	6 9 5
258,740	Stk	Sept. 11	5	Imperial Continental .		200—203	..	4 18 6
70,000	10	Oct. 15	11	Do. 3½ p.c. Deb. Red.		98—100	..	3 10 0
3,800,000	Stk.	Nov. 12	10	Lea Bridge Ord. 5 p.c.		113—118	..	5 1 8
473,600	Stk.	Aug. 13	3½	Liverpool United A		213—215	..	4 13 0
165,242	Stk.	Aug. 27	6	Do. do. B		163—165	..	4 4 10
561,000	Stk.	,,	10	Do. do. Deb. Stk.		110—112	..	3 11 5
718,100	,,	,,	7	Malta & Medn., Ltd. .		4¼—4⅜*	+⅛	5 5 3
306,083	,,	June 26	4	Met. of	5 p.c. Deb.	101—105	..	4 15 3
75,000	5	Dec. 11	5	Melbourne	4½ p.c. Deb.	100—102	..	4 8 3
560,000	100	Oct. 1	5	Monte Video, Ltd. . .		9—10	..	7 0 0
250,000	100	,,	4½	Newc'tle & G'tesh'd Con.		106—107	..	4 4 1
541,920	20	Nov. 12	3½	Do.	3½ p.c. Deb.	96—97	..	3 12 2
1,515,892	Stk.	Aug. 13	4½	Oriental, Ltd. . . .		135—140	..	5 14 4
376,855	Stk.	July 3	3½	Ottoman, Ltd. . . .		5⅜—6⅝	..	5 7 8
300,000	Stk.	Nov. 26	8					
600,000	5	Sept. 30	7					

* Ex div.

Issue.	Share	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
205,005	Stk.	June 26	6⅛	Ply'mth & St'house	5 p.c	123—128	..	4 15 8
851,070	10	Oct. 15	7	River Plate Ord. . .		10¾—11¼	..	6 4 5
300,000	Stk.	June 26	4	Do. 4 p.c. Deb. .		94—96	..	4 3 4
250,000	10	Sept. 30	8	San Paulo, Ltd. . . .		10⅜—11⅛	..	6 19 2
135,000	Stk.	Sept. 11	10	Sheffield A		240—242	..	4 2 8
209,984	,,	,,	10	Do. B		240—242	..	4 2 8
523,498	,,	,,	10	Do. C		240—242	..	4 2 8
116,106	Stk.	Sept. 30	5	Shrewsbury Ord. 5 p.c.		109—112	..	4 9 3
6,150,000	Stk.	Aug. 13	5⅛	South Met., 4 p.c. Ord.		116—119	− 3	4 9 6
1,780,000	,,	July 10	3	Do. 3 p.c. Deb. . .		86—89	− 1	3 7 5
380,940	Stk.	Nov. 12	5	Southampton Ord. . .		105—110	..	4 10 11
87,950	,,	July 10	4	Do. 4 p.c. Deb.		102—105	..	3 16 2
120,000	Stk.	Aug. 27	6	Tottenham and Edmonton	A. 5 p.c.	115—120	..	5 0 0
313,020	,,	,,	4⅛		B. 3½ p.c.	95—100	..	4 10 0
182,380	10	June 11	8	Tuscan, Ltd.		8—9	..	8 17 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.		98—100	..	5 0 0
737,142	Stk.	Aug. 13	5	West Ham, 5 p.c. Ord.		94—98	−1½	5 2 0
				WATER COMPANIES.			
781,517	Stk.	June 26	12†	Chelsea, Ord. . .		300—310	..	3 17 5
150,000	,,	,,	5	Do. 5 p.c. Pref. .		140—145	..	3 9 0
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75		131—136	..	3 6 2
175,785	,,	Sept. 30	4½	Do. 4½ p.c. Deb. .		132—137	..	3 5 8
1,720,560	Stk.	Oct. 15	8	East London, Ord.. .		205—215	..	3 14 5
654,740	,,	Dec. 11	4½	Do. 4½ p.c. Deb. .		133—138*	−2⅝	3 5 3
1,282,943	,,	,,	3	Do. 3 p.c. Deb. .		87—90*	−2	3 6 8
700,000	50	Dec. 11	10	Grand Junction	10 p.c. max..	115—120*	−⅛	4 3 4
310,000	Stk.	Sept. 30	4		4 p.c. Deb..	115—120	−5	3 6 8
708,000	Stk.	Aug. 13	10	Kent		265—275	..	3 12 9
160,000	,,	,,	7	Do. New, 7 p.c. max..		185—195	..	3 11 10
1,043,800	100	June 26	11	Lambeth, 10 p.c. max..		285—295	..	3 14 7
406,200	100	,,	8⅛	Do. 7⅛ p.c. max..		205—215	..	3 19 1
350,000	Stk.	Sept. 30	4	Do. 4 p.c. Deb..		115—120	−5	3 6 8
500,000	100	Aug. 13	12⅝	New River, New Shares		315—325	..	3 18 9
1,000,000	Stk.	July 29	4	Do. 4 p.c. Deb..		115—120	−1	3 6 8
902,300	Stk.	June 11	7⅛	South-wark and Vauxhall	Ord. . . .	220—230	−5	3 5 3
126,500	100	,,	7⅛		7⅛ p.c. max.	200—210	..	3 11 5
489,200	Stk.	,,	5		5 p.c. Pref..	140—145	..	3 9 0
1,019,585	,,	Oct. 15	4		4 p.c. A Deb.	115—120	−3	3 6 8
1,155,066	Stk.	Dec. 11	10	West Middlesex. . .		265—275*	−5	3 12 9
200,000	,,	,,	4⅛	Do. 4⅛ p.c. Deb. .		130—135*	−⅛	3 6 8
200,000	,,	Sept. 11	3	Do. 3 p.c. Deb. .		88—91	−1	3 5 11

* Ex div.

† Next dividend will be at this raet.

and interest upon the Staines reservoirs were to be dealt with. The Court had said they regarded this as a matter of fact. In that case, fresh tables would have to be prepared and submitted by the Company.

The PRESIDENT: We think you had better put the tables in.

Mr. BALFOUR BROWNE said he would do so the following morning. Subject to this, his case was now closed.

The PRESIDENT: I suppose the questions of the sinking fund and the Chamberlain's fund and sterilization would apply.

Mr. BALFOUR BROWNE: Yes.

The PRESIDENT: If we are right in our decision, we must apply these two.

Mr. BALFOUR BROWNE: If you can. My argument is that if you do apply the sinking fund, there is no advantage which can be touched by the sterilization clause.

Mr. MOULTON said it would be convenient for the Water Board to know on what points Mr. Balfour Browne was going to take a case.

Mr. BALFOUR BROWNE said he understood that the Court had decided that the sinking-fund clause was to apply. Suppose the Court of Appeal or the House of Lords should come to the conclusion that the sinking-fund clause was not to be applied at all? This, of course, would affect the Court's decision in the present case. He did not want half-a-dozen cases to argue it all over again.

The PRESIDENT: We cannot give a final award until this is ultimately decided. We shall consider whether we can make an alternative award or not. It is conceivable that we may take this course: We may find the sum payable supposing we are right on both points; the sum payable if we are wrong on both points; the sum payable if we are right in the first point and wrong in the second; and the sum payable if we are wrong in the first point and right in the second. Do you ask me for a special case in every instance? If so, we should be bound to grant it, I think; but it appears to me that is not justified.

Mr. BALFOUR BROWNE stated that the East London and the New River Companies' cases were analogous with regard to certain questions. The Staines matter was entirely between the Grand Junction, the New River, and the West Middlesex Companies; and he thought there would have to be a separate case there.

The PRESIDENT said that Staines was merely the sterilization and the sinking fund; and this had already been dealt with in the East London and the New River cases.

Mr. BALFOUR BROWNE pointed out that there was a question in dispute with regard to section 10 of the Metropolis Water Act, 1902. He thought this had better stand over until the other Companies had had an opportunity of considering it. He did not know the West Middlesex or the Lambeth Companies' cases.

Mr. MOULTON said he should certainly ask for a decision that section 10 created no new rights to compensation in regard to the Company's interest in the Staines reservoirs.

Mr. BALFOUR BROWNE: I am certain that the Companies do not want eight separate cases on the question of the sinking fund. So far as I can now see, one case on this would raise the whole question and decide it for all the Companies. We only want separate cases where the points are different—where one case would not raise all the specific points we want raised.

The PRESIDENT: If there are such cases, we will consider them. What do you ask us to declare?

Mr. BALFOUR BROWNE: I do not ask you to declare anything at this juncture. I ask you to consider, when you come to the figures, the claim we have preferred before you.

The PRESIDENT: I think we may say that we shall consider the interest of the Company in the undertaking of the Joint Committee; and any expenditure of the Company in respect of the undertaking will be a matter it will be our duty to consider, and Mr. Moulton does not ask the contrary.

Mr. MOULTON said what he asked was that clause 10 should neither give nor take away a right. He then proceeded to open the case on behalf of the Water Board. He said the Grand Junction case was far simpler than the previous ones. Water was drawn at the present moment directly from the Thames, and to a very large extent was supplied directly by the Company after passing through filtration; there was substantially no storage. The Board had never attacked the Company on the ground that it had an insufficient supply of filter-beds or an improper amount of storage. The Board's case with regard to the supply of the Company so far as quality was concerned was a very simple one—viz., that there were times when it was not a proper proceeding to take water from the Thames. The Company took it at all times; and he maintained that this was undesirable. The Company was bound to use its powers with regard to the Staines reservoirs. If storage was a desirable thing, and the Company had got the power of storage, they had no right to play fast and loose with Parliament in this way. With regard to the Company's claim to draw 24½ million gallons from the Thames, Counsel raised the point that the Thames Conservancy had no statutory right to sell water to the Company. There was no statutory sanction of the agreement of 1852 with the Corporation of London, or the agreement of 1886 with the Water Companies.

Mr. BALFOUR BROWNE said his point was that it had been decided in a case before the Courts—viz., *Thames Conservancy v. Southwark and Vauxhall Water Company*, in which the Conservancy sought to prevent the Company from drawing more than the quantity agreed upon by the 1886 agreement—that the 1886 agreement was valid.

The PRESIDENT pointed out that if the Water Board's contention that the Conservancy had no power to sell water was right, they would not have the power to take water when they took over the Company's undertaking.

Mr. MOULTON said that, in the present case, the point was comparatively unimportant, because unquestionably the Company had power to take water from the Thames for several years to come by means of the Staines Water-Works Act. In that case, the point was only important as strengthening the probability that the Company would have to take water from Staines.

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METROPOLITAN WATER BOARD.

Financial Matters—The Arbitration Proceedings.

A Meeting of the Board was held on Friday, at the Offices of the Metropolitan Asylums Board—Mr. R. M. BEACHCROFT presiding.

The Finance Committee presented a report, in the course of which a suggestion was made that an additional advance of money by the Bank of England should be applied for. On the 10th of July, application was sanctioned for £50,000—making, with the previous advance, £55,000. The Committee stated that there was a sum of £4797 standing to the credit of the Board, but that it was necessary, in view of payments which they were asked to order (including £7800 to the Local Government Board in respect of expenditure to be incurred by the Court of Arbitration up to the 1st of January next), to arrange for the provision of further funds. They therefore recommended that they be authorized to obtain from the Bank of England additional advances, not exceeding £75,000, to meet these payments. The Committee also submitted an estimate of £13,000 in respect of expenses connected with the arbitration.

The report was adopted.

The Special Arbitration Committee reported that on the 13th ult. the Board approved an estimate of £33 000 submitted by the Finance Committee in respect of expenditure to be incurred to the 31st inst. in connection with the preparation and conduct of the case of the Board before the Court of Arbitration. Previous estimates had been submitted amounting in the aggregate to £44,000; thus making a total vote of £77,000 in respect of the period ending the 31st inst. The Solicitors (Messrs. Linklater and Co.) had informed them that, in consequence of the decision of the Court to sit almost continuously up to Christmas, these estimates would be exceeded, and the total expenditure which they anticipated would be incurred up to the end of the year would be in excess of the sums hitherto voted by £13,000. They pointed out that, though the expenditure incurred was very heavy, the fact that the Court was sitting practically from day to day, and dealing more rapidly with the cases than was anticipated, would result in economy in the end. The Committee recommended that the further estimate of £13,000 submitted by the Finance Committee should be approved.

The recommendation was adopted.

The CHAIRMAN stated that the cases of the East London and New River Companies had been virtually heard. The case of the Grand Junction Company would be over, as far as hearing was concerned, that afternoon, and the West Middlesex Company's claim would be taken on Tuesday. It was probable that the Court of Arbitration would complete the first four cases before Christmas, and resume the inquiry on the 11th of January.

After transacting other business, the Board adjourned until the 22nd of January.

LEAD PIPES AND WATER CONSUMPTION.

A Fatal Poisoning Case.

An inquest which was held a few days ago at Dewsbury threw a considerable amount of light upon the question of the result upon the consumption of water of the employment of lead house pipes. It appeared from the evidence given by his father, that deceased (a man named Cooper) became ill about eighteen months ago from lead poisoning. The doctor who was called in advised the family to let the water run before using it; and the father remarked: "If I was to say we 'run away' hundreds of thousands of gallons of water, I should not be telling a lie." Deceased rallied from his first attack; but two or three months ago he again became ill. Meantime, samples of the water had been submitted to Mr. Dixon Shaw, Analytical Chemist, who said they were the worst he had ever seen. The father, in the course of his evidence, stated that his wife had complained repeatedly to the landlord, who ultimately, on receipt of a communication from the Mayor, substituted iron pipes for the lead ones. The doctor who made the post-mortem examination said that, in his opinion, the cause of death was lead poisoning, brought about by drinking water drawn from lead pipes. In reply to the Coroner, he admitted that, though there were more lead pipes in the district than iron ones, there were not many cases of poisoning—in fact, he could not say that there had ever before been a fatal result from water drinking. Some lead was more easily absorbed than others; and some people were more susceptible to attack than others. The Coroner remarked that there was no legal compulsion upon a landlord to put in iron pipes; but the case would serve as a warning to the public, who should run off the water before using it. The Jury returned a verdict in accordance with the medical testimony.

GUERNSEY WATER SUPPLY.

Some time ago we recorded the various stages in an agitation which ended in a petition being presented to the States of Guernsey for an investigation into the water supply. Mr. J. S. Beresford, C.I.E., the late Inspector-General of Irrigation in India, visited the island, and, after a lapse of some fourteen months, his report has been submitted to the parent body by the Select Committee who had the matter in hand. The report contains the life history of the Water Company, and deals at considerable length with the *modus operandi* of the present system of supply. Mr. Beresford says he has little doubt that there is room for extending the Company's well system on the plateau; but, in the absence of more assuring knowledge of the present installation than is now available, he is unable to recommend such an extension as a means of affording a permanent material increase to the water supply. The scheme suggested is the erection of a large storage reservoir at King's

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Mills, the gathering-ground of which is estimated at approximately 1500 acres. Assuming that 8 inches of rain, which is less than 25 per cent. of the annual fall, flows off this area in a year, the volume entering the reservoir would be, in round numbers, 272 million gallons. The provision of storage capacity sufficient for 150 days' supply, at 500,000 gallons per day, is the object aimed at; and the estimated capital cost is set down at £60,000. But included in this estimate is a modest sum of £9000 for 4 acres of land and compensation for mills—a price which is estimated by local experts advising the Committee as much too low, and is set down by them at £25,000. The probable capital cost would consequently be more like £76,000. The annual working expenses are estimated at £6000, and "for this sum annually there would be delivered, at a mean elevation of 280 feet, 182½ million gallons of filtered water. The cost would therefore be 8d. per 1000 gallons." The Committee submit the following proposals: (1) Whether notice shall be given to the Company, under Article 33 of their concession, to yield it up to the States. (2) Whether the States will vote a sum not exceeding £300 to enable the Committee to obtain a valuation of the property of the Company, or of such portion of it as they have acquired under their concession. (3) Whether they will authorize the Committee to take the necessary steps for the purchase of ground at the King's Mills. (4) Whether they will authorize the Committee to incur the necessary expense in collecting the full data asked for in Mr. Beresford's report.

We learn that locally the scheme is regarded as thoroughly practical, but far too expensive; and as the Company have expressed their willingness to increase the supply, it looks as if the above proposals will receive little support at the States Assembly.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Among other matters considered at the Dunfermline Town Council on Thursday, was a petition from the stokers in the gas-works, in which they asked for an advance in wages for the third men, and that they be rated the same as in other works where coal and coke handling plant is in use—viz., 4d. on the eight-hour shift, a reduction of the number of retorts from 42 to 33 per man per eight hours, and two eight-hour shifts off every three weeks. Consideration of the petition was delayed till the hydraulic apparatus in connection with the coal and coke handling plant has been completed, and its results, as affecting the work of the stokers, have been ascertained. Some time ago, the Corporation were communicated with by the County Council on the subject of their pollution of the Tower Burn by the discharge into it of water which had been used in the gas-works to wash coke. The Gas Committee have considered the matter, and reported on Thursday that they propose to acquire from the Earl of Elgin a piece of ground adjoining the works, upon which they propose to erect settling-tanks, whereby the pollution will, it is trusted, be obviated.

There was a discussion, at times not particularly complimentary, in the Kilmarnock Town Council on Wednesday, over part of one of the contracts for the erection of the new gas-works. The portion implicated was the coal-handling plant, with regard to which it was alleged that Messrs. Grant, Ritchie, and Co., of which Councillor Wm. Ritchie is a partner, had been executing part of the work. The contract is held by Messrs. Thos. Stewart and Sons. A Sub-Committee of the Gas Committee brought up a report on what is termed certain alleged irregularities. The minute of the Gas Committee stated that the Convener—Bailie Andrew Robertson—refused to receive the report of the Sub-Committee, on the ground that the remit that had been made to him had reference only to the coal-handling plant, and not to other contracts. It was upon this that the discussion arose. Mr. Ritchie denied that he had ever asked for work at the gas-works, or that he had ever tendered directly for any such work. Treasurer Gemmell thought the matter should be thoroughly investigated. Mr. R. Muir characterized the action of the Convener in refusing the Sub-Committee's report as the most high-handed proceeding he had ever known in connection with the Town Council. Bailie Robertson replied that he had been legally advised that the Sub-Committee's report was incompetent. The Council in the end approved of a motion by Mr. Gemmell, instructing the Gas Committee to inquire into and report upon the coal-handling contract and other work in connection with the gas-works.

Among other recommendations made by the Gas Committee of the Dumfries Town Council to the last meeting of the Council were—that, upon an application by large consumers of gas for trade purposes for a reduction in the price, no change be made during the present financial year; and that the salary of the Manager be increased by £50 a year as from Nov. 15 last. Mr. Currie, the Convener of the Committee, said that seven months ago the Manager's salary was reduced by £100 a year. Since then, he had given entire satisfaction to the whole Committee; and the prosperous year they had had showed plainly that Mr. Malam had attended to his work very judiciously. The Committee were quite unanimous that the salary should be increased; leaving the other £50 to be returned later on. Both recommendations were adopted. Upon the recommendation of the Lighting Committee, the Council agreed to substitute incandescent gas-burners for the ordinary burners in the public lamps in the principal streets of the town.

At the Aberdeen Town Council on Monday, the Gas and Electric Lighting Committee reported that they had had under consideration an application by the employees in the coke department for an increase of 2s. a week to their wages—making them 22s. to 23s. a week. After a long discussion, the recommendation of the Committee, that the increase be not given, was carried by 21 votes to 13.

This paragraph may contain information which will be of interest in the towns referred to; but even if it is not, it is a good illustration of how business is promoted by the officials of Trades Unions. In a

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SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	YORK (Second Contract)	750,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract)	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.)	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil)	125,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000	TORONTO (Fourth Contract)	1,000,000

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report of a weekly meeting of the Dundee branch of the National Union of Gas Workers and General Labourers, it is stated that "a very encouraging report was read from the Organizer for Scotland, and showed that the Paisley Town Council have granted the coal-wheelers employed in the Corporation gas-works an eight-hour shift instead of twelve hours, as hitherto, without any reduction of wages—recognizing in this action the justice of dealing directly with the Union. The organization is very active in Glasgow, as in almost all centres of industry in Scotland. In Dundee, it continues to make satisfactory progress, tending to the opening up of new ground. A new branch has been started, which includes the Leith and Edinburgh Gas-Works." The fact that there are no gas-works in Leith will not detract from the effect of this statement among those for whom it is intended. This is only a detail of the statement. The great principle is to keep moving—forward, if possible. The rate of progress which is considered satisfactory in Dundee is exhibited in the fact that nine new members were enrolled.

The Stirling Town Council have had under consideration the application of the Stirling Gaslight Company for a Provisional Order, in which they ask powers to increase their capital and to reduce the illuminating power of the gas. The Council unanimously agreed not to oppose the Order, but remitted to a Committee to confer with the Directors of the Company, and with powers to consult Mr. W. R. Herring, of Edinburgh, on the subject. This is surprisingly good of the Council. If public bodies more generally sought first-class advice, there would not be so much useless opposition to measures.

Judgment was given in the House of Lords on Monday in an appeal by the Clippens Oil Company, Limited, in an action against them by the Edinburgh and District Water Trust. The action was the leading one of a series of litigations between the two bodies. It had reference to the support of the pipes of the Trust. The Clippens Company are lessees of very valuable minerals—shale and limestone—in the estate of Pentland, Mid-Lothian. Two pipes belonging to the Water Trustees, and used for bringing water into Edinburgh, cross the lands of Pentland and Straiton. One of these pipes draws a supply from the Crawley springs in the Pentland Hills; and the questions raised in the appeal were whether the Trustees were entitled to a right of support for this pipe, and to prevent the Clippens Company from working minerals so as to endanger the pipe; or whether they could only acquire such right by paying compensation for the minerals requiring to be left unworked. The Lord Ordinary (Pearson), in the Court of Session, held that the Trustees had an absolute right of support for the pipe, and interdicted the Clippens Company from working the minerals within the zone of the pipe. The First Division of the Inner House practically affirmed this decision upon the merits of the case; but altered the form of decree into an interdict against working the minerals so as to injure the pipe. The Company appealed; but the House of Lords, following the opinion of the Lord Chancellor, has dismissed the appeal. The decision means a great loss to the Clippens Company. Had it been the other way, it would have been a great burden upon the Water Trust, because, in consequence of the interdict which has been operative since the case was brought, now two or three years ago, the Pentland works of the Company have been closed, and in another action they claim damages for the loss they have in consequence sustained. Any claim they may have on this head will, of course, now be an infinitesimal matter beside what it would have been had the Company been able to establish that the Water Trust had wrongfully put a stop to their working.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 12.

Sulphate of Ammonia.

There has been good demand, and everything available at last week's prices was picked up early in the week. Since then there has been keen competition for all parcels offered, and an improvement in prices all round, the closing quotations being £12 3s. 9d. per ton f.o.b. Hull, and £12 5s. per ton f.o.b. Liverpool and Leith. There has also been considerable buying for the month at the level of spot prices, and for January at a premium of 2s. 6d. per ton. There has been large inquiry in the forward position, January-June and April-September, but makers have become indifferent about selling, and whereas £12 10s. per ton, ordinary terms, f.o.b. Leith, was readily accepted last week, a substantial advance would have now to be paid to induce business.

Nitrate of Soda.

This is firm, and spot prices remain 9s. 6d. and 9s. 9d. per cwt., for ordinary and refined qualities respectively.

LONDON, *Dec.* 11.

Tar Products.

These remain in the same position, with the exception of pitch, which is decidedly weaker, especially for forward delivery. Prices quoted by makers for next year do not at all correspond with those asked by dealers; so that, with the exception of South Wales, there is very little business doing at the moment. Benzol is firm, especially for 90 per cent., which is in very strong demand for prompt delivery. A little business has been done in toluol at 8d. prompt, London. In carbolic acid, there is a quiet market for crude; but buyers will still pay 1s. 6d. to 1s. 6¼d. for January-June delivery. Crystals are decidedly dull. The German producers are monopolizing the business. Creosote is in very good demand, both for export and home consumption. Solvent naphtha is quiet; but with a fairly good demand for home consumption. There is nothing of importance to report in anthracene.

The average values during the week were: Tar, 23s. 6d. to 28s. 6d. Pitch, London, 41s. 6d. to 42s.; east coast, 40s. to 40s. 6d.; west coast, 40s. Benzol, 90 per cent., 10¾d. to 11d.; 50-90 per cent., 7¾d. to 8d. Toluol, 7½d. to 8d. Crude naphtha, 3½d.; solvent naphtha, 9½d. to 10½d.; heavy naphtha, 10½d. to 1s. Creosote, London, 1d. Carbolic acid, 60 per cent., 1s. 6d. to 1s. 6½d. Refined naphthalene, £5 to £8.

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Sulphate of Ammonia.

The markets are firm all round, with a very good demand for prompt and forward delivery. Beckton are not offering at all; but prices are nominally £12 8s. 9d. prompt, and £12 15s. January-June. In Hull, there has been a fairly good inquiry for prompt shipment, and £12 3s. 9d. has been paid in several instances; while, as a rule, makers decline to quote for next year. Business is reported in Leith at £12 3s. 9d. to £12 5s. for prompt; while £12 7s. 6d. has been declined January-June in more than one instance.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Uncertainty as to what may be the outcome of the refusal of the miners to accept the conditional terms of agreement for the Conciliation Board tends perhaps to create somewhat of an uneasy feeling in the coal trade; but there is no real apprehension that matters will be pushed so far as to bring about either a struggle on the wages question or break up of the Conciliation Board. Business still drags on in a slow, unsatisfactory fashion, with prices only about maintained at late rates. House-fire qualities are perhaps moving away rather more freely owing to extra buying before the holidays, and most of the pits are running practically full time. Supplies, however, are generally ample; and prices are only about steady at 13s. 6d. to 14s. 6d. per ton for best sorts, 11s. and 11s. 6d. to 12s. 6d. for seconds, and 9s. 6d. to 10s. 6d. for common. Steam and forge coals remain in much the same indifferent request as reported for some time past, and prices continue to be cut low for clearance sales, with average quotations about 7s. 9d. to 8s. 3d. per ton for common, and 8s. 3d. to 8s. 9d. for the best qualities. The better descriptions of engine fuel are maintaining a fairly strong position, some collieries being short of supplies; but inferior sorts continue plentiful. Taking prices all through, except that the best qualities of slack perhaps show some hardening, there is no real improvement upon late rates. Common slacks are still obtainable at 4s. to 4s. 6d. per ton at the pit, medium sorts 5s. to 5s. 6d., and best qualities 6s. 3d. and 6s. 6d. up to 6s. 9d. Shipping is unchanged, with steam coals delivered at the ports on the Mersey ranging from 9s. and 9s. 3d. up to 9s. 6d. and 9s. 9d.

Northern Coal Trade.

The demand for coals has been very full of late. Storms have at times, however, interfered with the shipment; and this has made some of the collieries have occasional idle days. In the steam coal trade, this is most apparent; for the dull season in this class of coal is when the Baltic is closed. Best Northumbrian steams are 9s. 6d. per ton f.o.b., second-class steams are 8s. 3d. to 8s. 6d., and steam smalls 4s. to 4s. 6d. In the gas coal trade, the demand is now at its fullest, and more settled weather has allowed fuller shipments in the past few days. Durham gas coals vary in price, according to quality, from 8s. to 9s. per ton f.o.b.; but the better qualities are relatively the scarcest in supply and steadiest in price. Gas coke is now more plentiful, with some irregularity in price, according to the stocks held by producers. From 14s. to 14s. 6d. per ton f.o.b. may be taken as the medium quotations.

Scotch Coal Trade.

An easy trade is being done; the home demand being better than the foreign. Outputs are thus being disposed of. This is partly owing to the practice of laying in stocks prior to the holidays, in anticipation of the miners not working full time when they arrive. Prices do not improve. They are: Main 7s. 6d. to 7s. 9d. per ton f.o.b. Glasgow, ell 8s. 6d. to 9s. 6d., and splint 9s. 3d. to 9s. 6d. The shipments for the week were 191,377 tons—a decrease of 30,683 tons upon the previous week, and of 33,967 tons upon the corresponding week of last year. For the year to date, the total shipments have been 10,674,693 tons—an increase of 191,019 tons upon the same period of last year.

Caton Water-Works Purchase.—An inquiry was recently held at Caton, by Major J. Stewart, on behalf of the Local Government Board, into an application by the Lunesdale Rural District Council for sanction to borrow £11,450 for the purchase of the Caton Water-Works. The amount was made up of £10,396 the award in the arbitration which took place some time ago, £547 the vendors' costs, and £506 the costs of the Council. It was asked that the loan should be spread over a period of thirty years.

Water Supply of Nice.—With a view to improving the water supply of Nice, it is proposed to unite the waters of several important sources in the vicinity of Grasse, at a height of 3000 feet. These are the waters of the Gravière, the Bouisse, and the Veguay, which will be in a short time conveyed by a covered canal direct to Nice from the springs whence they rise. According to the Nice Correspondent of the "Standard," the total length of the canal will be about 37 miles, and it will arrive at Nice at a height of 1000 feet on the hill of St. Pierre de Feric, where a reservoir of about 6½ million gallons capacity is to be built.

Gosport Water Supply.—The proposal by the Gosport Water Company to apply to Parliament for power to establish new works in the Meon Valley for improving their supply, at a cost of £50,000, is meeting with a large amount of opposition. The Fareham Urban District Council object to the mains being laid in their principal thoroughfares, to the detriment of their own sewers, water and gas pipes, and the electric light conductors; and the Droxford Rural District Council have expressed fears lest the water required for Shedfield, Soberton, Swanmore, Curdridge, and Waltham Chase should be drawn away. A Special Committee composed of representatives of the affected parishes are to report upon the matter.

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New Water Reservoir at Greenfield.—Plans are being prepared for the construction of a large reservoir in the Chew Valley, Greenfield. It will have a holding capacity of more than 100 million gallons. It is to have a higher level than any of the reservoirs owned by the Ashton, Stalybridge, and Dukinfield Joint Water-Works Committee, and will be equal to supplying the highest situated houses within the district supplied by the Committee.

London Water Companies' Charges.—At the meeting of the London County Council last Tuesday, it was resolved, on the motion of Dr. Fletcher Little—"That, in view of the large sum claimed by the London Water Companies based on receipts from rates levied on coach-houses, stables, out-houses, and gardens, in addition to the amount already levied on the rateable value of the whole premises, the attention of the Metropolitan Water Board be called to the subject."

A Tedious French Artesian Boring.—According to "La Nature," the artesian well of the Butte-aux-Cailles, the driving of which was commenced in 1866, stopped in 1870, and resumed in 1892, has been completed. The second water level was reached on the 19th ult., at a depth of about 650 yards. Last year, after extraordinary difficulties, the first water level was reached, at a depth of 624 yards. The discharge was then 175,000 gallons per 24 hours; whereas at present it is upwards of 1¼ millions.

Wanted, More Light at Redruth.—A good deal of dissatisfaction was expressed at the last meeting of the Redruth District Council as to the poor results given by the electric light in some parts of the town. It was said that, on a recent Saturday night, the town was in semi-darkness; and that on other nights some of the lights had been hardly worthy of the name. The Clerk reminded the Council that as long ago as Sept. 29 he called the attention of the Urban Electric Supply Company to complaints then made as to deficient lighting. A formal acknowledgment of this letter might have been made; but no attention had been paid to the complaint. It was decided that he should write again.

Extension at the Penrith Gas and Water Works.—At the last monthly meeting of the Penrith Urban District Council, it was reported that approximate estimates of the cost of certain proposed extensions and improvements at the gas-works had been submitted to the Gas Committee by Mr. J. Timmins, M.Inst.C.E., the Council's Consulting Engineer, and the Manager of the works (Mr. E. Shaul). It was resolved to carry out extensions at an estimated cost of £7000. The Council authorized the Committee to have the necessary plans, specifications, and detailed estimates prepared, in readiness for a Local Government Board inquiry into the scheme. On the same occasion, it was decided to adopt Mr. Baldwin Latham's scheme for improving the water supply at a cost of £13,400.

Skipton's Water Scheme.—A meeting of the Skipton ratepayers was held on Monday last week, to discuss the Council's proposed water scheme, which is estimated to cost £72,000. Mr. J. Platt, who presided, advocated a smaller scheme, providing for a period of about 50 years, instead of 150 years, as contemplated in the present project. A resolution recording emphatic disapproval of the Council's decision to promote a Bill in Parliament for an additional supply of water, without having first taken the ratepayers into their confidence, and protesting against "rushing" so important a proposal without full consideration, was submitted. The mover asserted that the suggested expenditure would increase the rates of the town by 2s. 6d. in the pound; but Mr. C. Smith, a member of the Council, defended the scheme, and contended that the increase in the rates would only be 1s. 1d. in the pound. The resolution was carried.

Halifax Water Supply.—In the course of a lecture which he delivered recently, Mr. James Parker, the Chairman of the Halifax Water Committee, gave some interesting particulars with regard to the undertaking. Referring to the reservoirs in course of construction at Walshaw Dean, he said it was estimated by the Engineers, and also by the Contractor, that a water-tight base would be found for the trenches at a depth of 66 feet. Unfortunately, this water-tight base had not been found at 66 feet, and at present they were down at a depth of 108 feet. The result was that all this extra work would have to be added to the cost of construction. There were 23 miles of railway inside the works, two stone quarries, and one clay puddle field from which clay was obtained. The reservoirs would be 1¾ miles in length; and over the whole of this there would be a flood-water course, 18 or 20 feet wide at the top, and 6 or 8 feet at the bottom, to carry the flood water and turn it either in, or convey it past, the reservoirs. Water would be able to be drawn from one reservoir, or from any two, without interfering with the other, or all three could be used together. As to the cost, he was unable to say what it would be.

Electric Lighting in Exeter.—A portion of the new electricity works erected by the Corporation of Exeter was a few weeks since brought into use. The undertaking is by no means complete; but the construction of the building and the erection of the plant have reached such a stage that part of it is available for use, and this is being employed to supplement the output from the old works, on which the pressure has been excessive since the advent of winter. The Mayor (Mr. F. J. Widgery) performed the formal ceremony of switching on the current. There were the usual complimentary speeches; and the Mayor and Alderman Wreford, the Chairman of the Electric Lighting Committee, joined in congratulating the Engineer (Mr. H. D. Munro), the Contractors, and everyone concerned, on the success which has so far attended their efforts in connection with the business. Mr. Wreford said that since the Corporation acquired the electricity works from the old Company the undertaking had not cost the ratepayers a penny; and he hoped it never would. The machinery in the new works comprises three sets of engines and dynamos, each of 400 kilowats, and a small set of about 100 kilowats. A comparatively new set from the present works will be added later. So far only one of the large sets at the new works is being used; and as one of these is nearly equal to supplying all the current generated at the old works, it would seem that the Corporation are making more than ample provision for the electric lighting of the city in the immediate future.

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The Slot-Meter Business at Devonport.—It was reported at a meeting of the Devonport Town Council on Thursday, that application had been made to the Local Government Board for sanction to borrow the sum of £45,000, to defray the estimated expenditure during the next five years on the purchase of gas stoves, meters, &c., for the installation of automatic supplies. The Board, in reply, pointed out that it was contrary to practice to sanction a loan for prospective expenditure spread over a longer period than three years. The Gas Committee thereupon resolved to apply for a loan of £35,000—the estimated expenditure during the next three years. Mr. Hornbrook, the Chairman of the Committee, in answer to a question, said that the Committee were perfectly satisfied with the manner in which the automatic installation business was being worked. The fact that they were asking for this additional expenditure was proof of that. The action of the Committee was approved.

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., on Tuesday, Mr. Alfred Richards placed new issues of capital by the Southend and the Harrow and Stanmore Gas Companies. The amount offered by the former Company was £4570, in 4 per cent. perpetual debenture stock; and it fetched from £100 to £100 15s. per £100 of stock. The latter Company's new issue was in "C" 7 per cent. shares, of which 300 were put up, and realized from £12 to £12 5s. each. The last dividend on similar shares was at the rate of £6 9s. 6d. per cent. per annum. On the same occasion, Mr. Richards sold some fully paid £10 ordinary shares (last dividend 7 per cent.) at £13 5s. each, *cum div.* from the 1st of July last. At Bristol, last Friday, Messrs. Nichols, Howes, Young, Alder, and Co. sold, in accordance with the announcement in our advertisement columns, £15,000 of 5 per cent. maximum capital stock and £5000 of new 4 per cent. debenture stock of the Bristol Gas Company. The stock was offered in lots of £100; the minimum prices fixed being £110 and £100 respectively. The capital stock was placed at figures ranging from £110 up to £112 5s. per lot; the debenture stock fetching £100 5s. to £101 5s.

Southport Gas Supply.—The half-yearly report on the Gas Estate of the Southport Corporation has been published. The gross profit this year is £5395, while last year it was £5224; and the deficit now is £678, against £826. The income from gas-rents is £19,763, against £19,422; from the hire of cookers, £908, compared with £863; and from the sale of residuals, £4535, against £5379. On the other hand, the expenditure on coal, cannel, and oil has dropped from £9330 to £7651. The total make of gas was 86,433,000 cubic feet—an increase of 6,584,000 cubic feet; and the total sale was increased by 7,651,700 cubic feet. This shows a falling off in the leakage. The great increases are all in private lighting—Southport, 6,094,000 cubic feet; Birkdale, 544,200 cubic feet; Ainsdale, 135,200 cubic feet. Prepayment-meter supplies show the following increases: Southport, 437,000 cubic feet; Birkdale, 216,400 cubic feet; Ainsdale, 5900 cubic feet. The public lighting increase in Southport is 343,500 cubic feet; and in Birkdale, 117,300 cubic feet. There is a decrease in the quantity of gas sold for cooking in Southport of 220,800 cubic feet, in Birkdale of 29,800 cubic feet, and in Ainsdale of 19,400 cubic feet. At the meeting of the Town Council on Tuesday, the Chairman of the Gas Committee (Mr. Trounson) explained that the figures relating to the consumption of gas for cooking purposes were misleading. They showed a decrease, whereas there had, in fact, been an increase. It was caused through the abolition of the dual meter system. They had done away with upwards of 300 of these meters; but the losses had been more than made up by new consumers for cooking and heating purposes.

The Igneous Cement Company have removed their offices to No. 2, Copthall Buildings, E.C.

The Barking Gas Company, as will be seen by the announcement which appears in our advertisement pages, are inviting tenders for an issue of £11,656 of 4 per cent. redeemable debenture stock.

In consequence of the contemplated transfer of the Devonport Water-Works to the Corporation, Mr. H. Francis, M.Inst.C.E., as already announced in the "JOURNAL," has retired from the position of Engineer and Manager, after more than thirty years' service. He has now commenced practice as a Civil Engineer at No. 12, Lockyer Street, Plymouth.

The International Anthracite Association, Limited, has been registered, with a capital of £20,000, in £1 shares, to carry on the business of colliery proprietors and agents, miners, quarrymen, and merchants and dealers in anthracite or other coal, manufacturers of coke, fuel, ironstone, steel, clay, stone, and other minerals and metals, and the products thereof, &c. There will be no initial public issue of the Company's capital.

The Kidderminster Gas Company have placed an order with Messrs. C. & W. Walker for a set of three of Milbourne's patent purifiers, 30 feet square and 5 ft. 6 in. deep, with 18-inch connections. Each purifier will be fitted with Milbourne's patent grid valve, arranged in such a manner as to bye-pass just as much of the purifying area as has become useless by the caking of the oxide. The whole of the work will be carried out under the superintendence of Mr. A. Dougall, the Gas Company's Engineer and Manager.

At a recent meeting of the Clacton-on-Sea Urban District Council, tenders were opened for the supply of cast-iron pipes for the Gas and Water Department. The lowest tender was submitted by a local firm for French-made pipes, at £5 11s. 6d. and £5 5s. 6d. per ton, according to size; the next tender being that of a London firm for British-made pipes at £5 15s. and £5 12s. 6d. per ton. Some discussion took place as to accepting the lowest tender (which it was stated had been the rule of the Council, provided the articles were satisfactory), as the goods offered were not British made; and it was urged that the Council should spend every shilling possible in England. In the end, the tender of the local firm was accepted.

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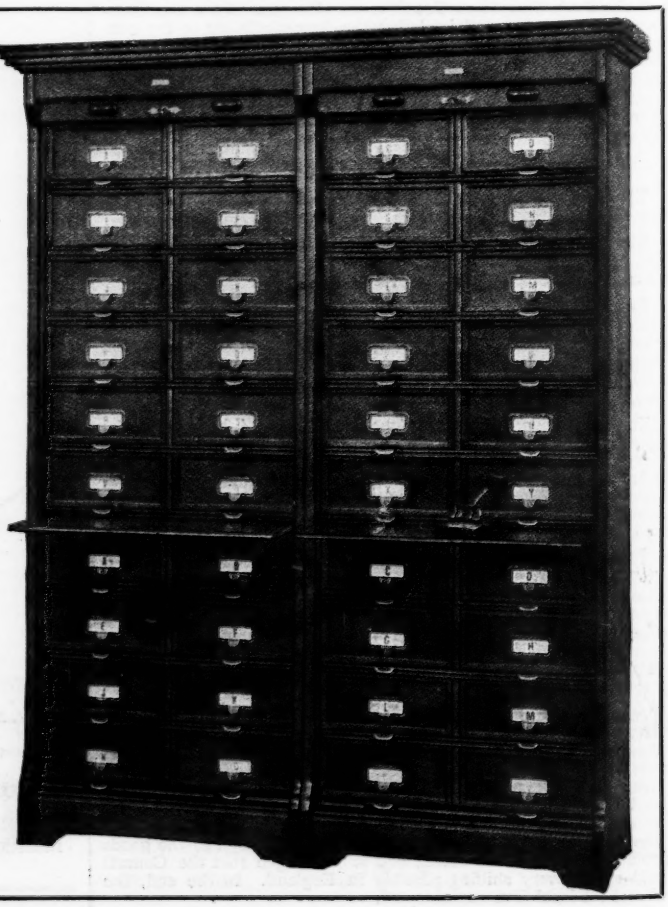

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

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All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE has a larger annual sale than all other Oxides combined.

SPENT OXIDE purchased in any district.

GAS PURIFICATION & CHEMICAL CO., LD.

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PALMERSTON HOUSE, LONDON, E.C.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

SULPHATE OF AMMONIA SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.
For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
Largest Practice and most Up-to-Date Works in Britain.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPECIAL PAINT FOR GAS-WORKS.

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VICTORIA PAINT WORKS,
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Telegrams: "ENAMEL." National Telephone 1759.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

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BROTHERTON AND CO., LTD., Tar Distillers.
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HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
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BROTHERTON AND CO., LTD., Ammonia Distillers.
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H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.
Telephone: 1698 HOP. Telegrams: "LUMINOSITY."

WANTED, a Situation as Assistant-MANAGER. Four-and-a-half Years' Experience with a Western Gas Company. Well up in Photometry, Testing for Impurities, and the General Routine of a Gas-Works. Age 21. Articled.
Address No. 4135, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A GENTLEMAN, who has represented a well-known Firm of Gas Engineers for over Ten Years, seeks change. Very well known and popular among the Profession, Surveyors, Architects, and Builders, and can introduce a unique connection in Railway Work.
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J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
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THE First Dutch Bog Ore Co., Ltd., (Eerste Hollandsche Yzererts Maaty), ROTTERDAM.
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SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER, CHAPMAN, AND MESSEL, LIMITED, 36, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
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AMMONIACAL Liquor wanted by JOHN RILEY & SONS, Hapton, near ACCRINGTON.

PATENTS AND TRADE MARKS PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

TWO Apprentices wanted by a Firm of Contracting Gas Engineers. Must be well Educated.
Apply, giving full Particulars, to No. 4132, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at once, a Stoker, used to Shovel Charging. Wages 30s. per week.
Apply to the MANAGER, Gas-Works, SUNBURY-ON-THAMES.

GAS and Electric Installations: Outdoor FOREMAN wanted, to look after work and to call upon Architects and Builders. One who thoroughly understands his business. On Salary and Commission.
Apply, by letter, stating Age, Experience, and Salary required, to No. 4138, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Suburban Gas Company, a Smart Young Man to act as CANVASSER, METER READER, and STOVE INSPECTOR, and to make himself Generally Useful. Uniform will be worn. Wages to commence with 25s. per week.
Apply, by letter, to No. 4137, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DRAUGHTSMAN wanted in an Engineer's London Office. Must be fully conversant with all the details in connection with Gas-Works Construction, including Gasholders, Engines, Machinery, and Plant, and must be able to use the Theodolite.
Applications to be made by letter, with full Particulars, and stating Salary required, to No. 4139, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

COAL GAS TAR wanted.
Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered either on Fixed or Sliding-Scale Basis.
State Quantity to offer for Prompt and Forward Delivery.
The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

OXIDE OF IRON.

(NATURAL.)

BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.
BALE'S FIRE CEMENT, PAINT, AND GAS COAL,
5, CROOKED LANE, LONDON, E.C.

1500 Feet Cowan Station Meter, with 4-inch Connections and Bye-Pass Valves, in Good Working Order, FOR SALE.
SHEPSHED GAS-WORKS, LEICESTERSHIRE.

TO BE SOLD — Twin-Cylinder Gas-ENGINE, 6 n.h.p., by Crossley; Cylinders 8 in. diameter by 18 in. stroke, and Gas-Bag.
NEW GASHOLDER SHEELS, 40 feet diameter by 12 feet deep, and 50 feet diameter by 15 feet deep, with or without New Steel Tanks and Standard Guides.
Write J. WRIGHT, 181, Queen Victoria Street, LONDON, E.C.

TO MALSTERS, CEMENT AND BRICK MANUFACTURERS, LIME BURNERS, AND OTHERS.

BEST Screened Gas Coke and Breeze FOR SALE.
Wholesale Prices can be obtained at the GAS-WORKS, SWANSEA. By Shipment or by Rail direct.

GAS-WASHER PATENT FOR SALE.

THE English Patent for the "Burgemeister Gas-Washer," described in the "JOURNAL" for Oct. 13 last, p. 102, is for SALE.
For Particulars, apply to F. BURGEMEISTER, Ingénieur, Director der Gasanstalt, Celle, Hanover, GERMANY.

TAR Contracts Wanted on the Sliding- Scale or at Fixed Prices.
Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND CO., Ouse Chemical Works, SELBY.

THE Directors of the Worksop Gas Company invite TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR made at their Works during the Twelve Months commencing the 1st of January, 1904.
Tenders for Tar to state price per ton delivered into Purchaser's Tanks at the Worksop Railway Station.
Tenders for Liquor to state price per ton as tested by No. 1 Twaddel Hydrometer, delivered into boats near the Company's Works, or price per ton delivered into Purchaser's Tanks at the Railway Station.
The Directors do not bind themselves to accept the highest or any Tender.
Tenders to be sent in by the 28th of December.
Worksop, Dec. 9, 1903.

GAINSBOROUGH URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

TENDERS FOR AMMONIACAL LIQUOR.

THE Gas Committee of the above Council are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR produced at their Gas-Works for a period of Twelve Months from the 1st of January, 1904.
Further Particulars may be obtained on application to the undersigned.
Sealed and endorsed Tenders, addressed to the Chairman of the Gas Committee, must be delivered at the Gas-Works, Gainsborough, not later than Tuesday, Dec. 29, 1903.
The Committee do not bind themselves to accept the highest or any Tender.

JOHN PALDWIN,
Manager.

Gas-Works, Gainsborough.
Dec. 10, 1903.

WILMSLOW AND ALDERLEY EDGE GAS COMPANY.

THE Directors of the above Company invite TENDERS for the supply of 72 Tons of OXIDE of IRON for Gas Purification; also for the purchase of SPENT OXIDE (about 140 Tons).

Sealed Tenders (stating price per ton for new, and price per unit for spent, delivered at Wilmslow Station) endorsed "Oxide," to be addressed to the Chairman, and delivered not later than the 23rd of December, 1903.

Further Particulars may be had on application to the undersigned.

W. SEVERS,
Engineer and Manager.

Gas-Works, Wilmslow,
Dec. 10, 1903.

CITY OF LEEDS.

(GAS DEPARTMENT.)

THE Gas Committee of the Leeds Corporation are prepared to receive TENDERS for the supply of FIRE-CLAY RETORTS, FIRE-BRICKS, FIRE-BRICK LUMPS, and FIRE-CLAY.

Specification and Form of Tender may be had on application to the undersigned.

Tenders, addressed to the Chairman of the Gas Committee, and endorsed "Fire Goods," must be delivered at the Gas Offices, East Parade, Leeds, not later than Monday, the 21st inst.

The Committee do not bind themselves to accept the lowest or any Tender.

R. H. TOWNSLEY,
General Manager.

Gas Offices,
East Parade, Leeds,
Dec. 8, 1903.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS from Iron-founders, Gunbarrel Manufacturers, Timber Merchants, Druggists, Ropemakers, &c., for GOODS to be delivered on the Company's Works, Great Brunswick Street, in such quantities as may be required from time to time up to the 31st of December, 1904.

Samples of Goods required are open to inspection on the Works, Great Brunswick Street, and printed Lists of Articles required can be had on application at the Company's Offices, D'Olier Street.

Tenders, endorsed "Tenders for Stores," to be lodged in my Office, on or before the 27th inst.

FRANCIS T. COTTON,
Secretary and Manager.

Head Office: D'Olier Street,
Dublin, Dec. 12, 1903.

COUNTY BOROUGH OF BIRKENHEAD.

TO OIL IMPORTERS AND DISTILLERS.

THE Corporation of Birkenhead are prepared to receive TENDERS for the supply of about 3000 Tons per Annum of GAS OIL, for the manufacture of Carburetted Water Gas, delivered free into their Oil-Stores at Ilchester Wharf, Birkenhead Docks, for a period of One or Two Years. Deliveries as the Gas Engineer may direct.

The Oil to have a specific gravity of not over ·875 at 60° Fahr., with a minimum flash-point of 100° Fahr., and containing no residuum.

Samples of the Oils tendered for, together with analysis, must be sent to the Gas Engineer, at the Gas-Works, and properly labelled with the name of the firm and the number and name of the Oil corresponding to the Tender.

Any other Information may be obtained from the Gas Engineer, Mr. T. O. Paterson, M.Inst.C.E., Gas-Works, Thomas Street, Birkenhead.

Tenders, stating price per Imperial Gallon, sealed and endorsed "Tender for Gas Oil," to be sent in to me not later than Five o'clock in the afternoon of Thursday, Dec. 17, 1903.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
ALFRED GILL,
Town Clerk.

Town Hall, Birkenhead,
Dec. 7, 1903.

TO CHEMICAL MANUFACTURERS.

THE Corporation of Birkenhead are prepared to receive TENDERS for the purchase and removal of about 120 Tons of SPENT OXIDE OF IRON now lying at the Gas-Works.

Forms of Tender and samples may be obtained from Mr. T. O. Paterson, Gas Engineer, Gas-Works, Thomas Street.

Tenders, sealed and endorsed "Tender for Spent Oxide of Iron," to be sent in to me not later than Five p.m. on Thursday, Dec. 17, 1903.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
ALFRED GILL,
Town Clerk.

Town Hall, Birkenhead,
Dec. 7, 1903.

BARKING GAS COMPANY.

THE BARKING GAS ACTS 1867 AND 1902.

ISSUE by Tender of £11,666 Redeemable DEBENTURE STOCK, bearing Interest at the rate of £4 per cent. per annum.

Particulars and Conditions of Tender may be obtained on Application at this Office.

Tenders must be sent in not later than Five p.m. on the 31st of December, 1903.

The Directors do not bind themselves to accept the lowest or any Tender.

By order of the Directors,
STURT MORRIS,
Secretary.

Offices of the Company:
Gas-Works, Barking, Essex.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation invite TENDERS for the supply of: (1) IRONMONGERY, (2) STEEL GOODS, (3) FIRE-CLAY GOODS, (4) IRON VALVES and CONNECTIONS, (5) WET and DRY GAS-METERS, (6) TARRED GASKIN, required during the ensuing Twelve Months.

Forms of Tender and further Particulars may be obtained on application to Mr. John Wilkinson, Engineer, Gas-Works, Halifax.

Tenders, endorsed "Gas-Works," together with the names of the Articles tendered for, must be sent to the undersigned not later than Twelve o'clock noon on Wednesday, the 23rd of December, 1903.

The persons whose Tenders are accepted will be required to observe the Fair Contracts Clauses adopted by the Corporation.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

SELBY URBAN DISTRICT COUNCIL.

TO WELL SINKERS.

THE Urban District Council of Selby, Yorkshire, invite TENDERS for the construction of a BORING 400 feet deep, to be carried out in the adjacent parish of Brayton.

Copies of the Specification and Form of Tender, together with any other Information, can be obtained from Mr. Percy Griffith, M.Inst.C.E., F.G.S., 54, Parliament Street, Westminster, S.W., or from Mr. Bruce McGregor Gray, Assoc.M.Inst.C.E., Town Hall, Selby, upon payment of a sum of five pounds, which will be returned on the receipt of a *bonâ-fide* Tender.

Tenders must be delivered in the proper Sealed Envelopes, endorsed "Tender for New Boring," addressed to me at the Town Hall, Selby, not later than Twelve noon on Monday, the 21st day of December, 1903.

By order,
J. H. BANTOFT, Solicitor,
Clerk to the Urban District Council.

Town Hall, Selby,
Dec. 3, 1903.

HORNSEY GAS COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, relating to DEBENTURE STOCK ONLY, WILL BE CLOSED on the 17th inst., and RE-OPENED on the 1st of January, 1904.

By order of the Board,
WILLIAM E. ROBERTS,
Secretary.

63, Chancery Lane, W.C.,
Dec. 17, 1903.

NORTH MIDDLESEX GAS COMPANY.

SALE BY TENDER OF
£3000 FIVE PER CENT. PREFERENCE STOCK
AND 300 SEVEN PER CENT. ADDITIONAL
ORDINARY SHARES OF £10 EACH.

NOTICE is Hereby Given, that the Directors of the North Middlesex Gas Company will offer the above Stock and Shares for SALE BY TENDER during the ensuing period ending the 29th of December, 1903, the last day for the reception of Tenders being Tuesday, the 29th of December, 1903.

Particulars of the Sale and Forms of Tender may be had on Application to the undersigned, or at the District Office of the Company, No. 11, The Broadway, Church End, Finchley.

By order,
ERNEST L. BURTON,
Secretary.

Secretary's Office:
5 & 6, Great Winchester Street,
Old Broad Street, London, E.C.
Nov. 27, 1903.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

THE
PETROLEUM GAS SYNDICATE
Supply and erect Complete Installations of their
PETROGENE PATENT GAS PLANT
On SALE, HIRE, or ROYALTY.

PETROGENE GAS is the most suitable Illuminant for all Towns, Villages, Factories, Institutions, &c., where a Cheap and Efficient Lighting System is required. It is equally suitable for Heating and Power purposes, and may be used with ordinary Gas Fittings, Stoves, Engines, &c. It may also be used in conjunction with Coal Gas, and affords Gas Companies a ready means of increasing their output without the expense of additional storage.

The Syndicate is prepared to entertain offers of sale of small Gas-Works, whether profit earning or not.

Offices: 28, Victoria St., Westminster.
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VOLUMES OF THE "JOURNAL"
(GREEN CLOTH, GILT LETTERED)

COKE-BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
With Elevators and Conveyors worked by Steam or Gas Engine.
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And at STROUD, GLOUCESTERSHIRE.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
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NEWBATTLE COLLIERIES,
DALKEITH, N.B.

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SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
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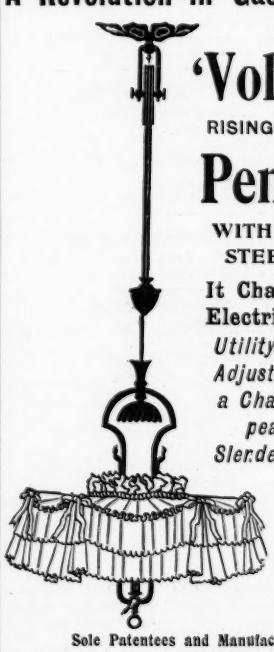
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

A Revolution in Gas-Fittings
IS THE
'Volonta'
RISING & FALLING
Pendant
WITH FLEXIBLE STEEL TUBES.
It Challenges the Electric Light for *Utility, Novelty, & Adjustability, and a Charming Appearance of Slender Elegance.*



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"AVERY SIMPLE & INGENIOUS APPARATUS."—
VIDE "THE ENGINEER" NOV 12TH 1897

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The "Evertrusty" Draught Indicator, also known as Jensen's Flutometer (Regd. Trade Mark),

For Retorts, especially for Retorts set on the Regenerative Principle for maintaining the desired pull or draught on the flues.

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CANNEL COAL MERCHANT,

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Prices and Analysis of all the Scotch Cannels on Application.

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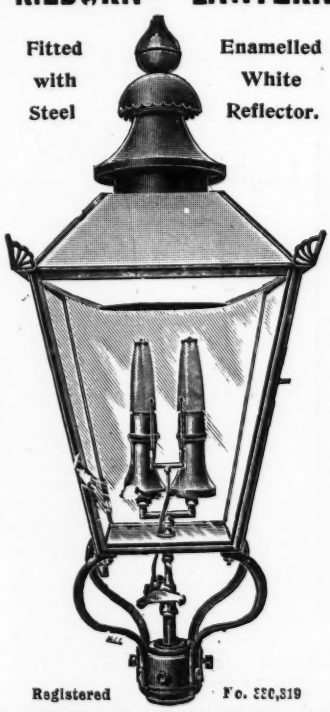
Fitted with Steel

Enamelled White Reflector.



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Surrey Engineering Works,

Blackfriars Road, LONDON.

Telephone 1693 HOP.

Telegrams: "LUMINOSITY LONDON."

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That will satisfy your most fastidious Customer.

BRILLIANT. WARM. NOISELESS.

Send small Sample Order.
Your further Orders will follow.

THE IMPERIAL STOVE CO.,
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Telegrams: "Imperial, Leamington."
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GOLD MEDAL FOR COOKERS AWARDED 1903.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.

Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

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HAVE ACQUIRED THE PATENT

"HELICOID" LOCK-NUT.

A Coil of Steel Gripping Automatically with Immense Power.

SECURITY. ECONOMY. DURABILITY.

THE MORE THE VIBRATION THE TIGHTER THE NUT GRIPS.

Made from ⅛ in. to 2 in. Price from 10s. 9d. per gross.

COMPLETE LIST FREE.

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IRON AND WIRE

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GATES, &c.

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FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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THOMAS DUXBURY & CO.,

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Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

Telegrams: "DARWINIAN, MANCHESTER."

Telephone 1806.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars, Price, &c., apply to Mr. EDWARD PRICE, "Langley," Wyke Avenue, WORTHING.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY

RAVENSTHORPE, NEAR DEWSBURY.

THE SILICA FIRE-BRICK COMPANY,

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SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

WELDON MUD

FOR

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For use in the

RECOVERY OF SULPHUR,

Also Removal of last Traces of

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in catch position.

Full Particulars on application to the Patentees:

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— LIMITED, —

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R. LAIDLAW & SON,
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GAS & WATER ENGINEERS,

SIMON SQUARE WORKS, EDINBURGH.

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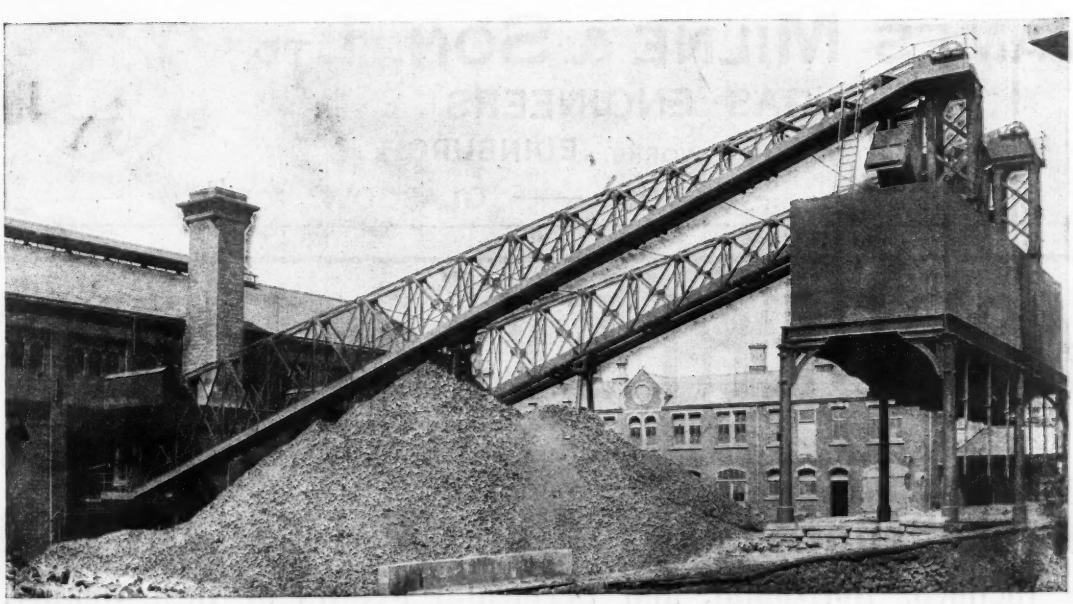

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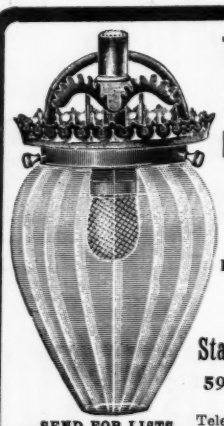

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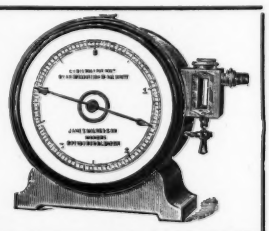

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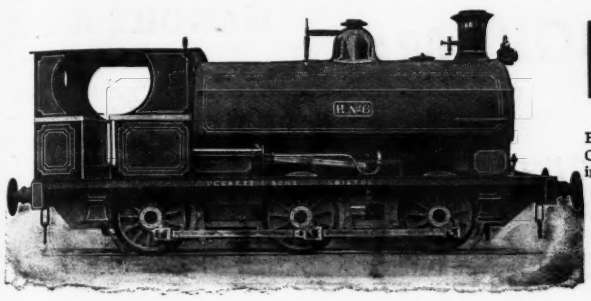

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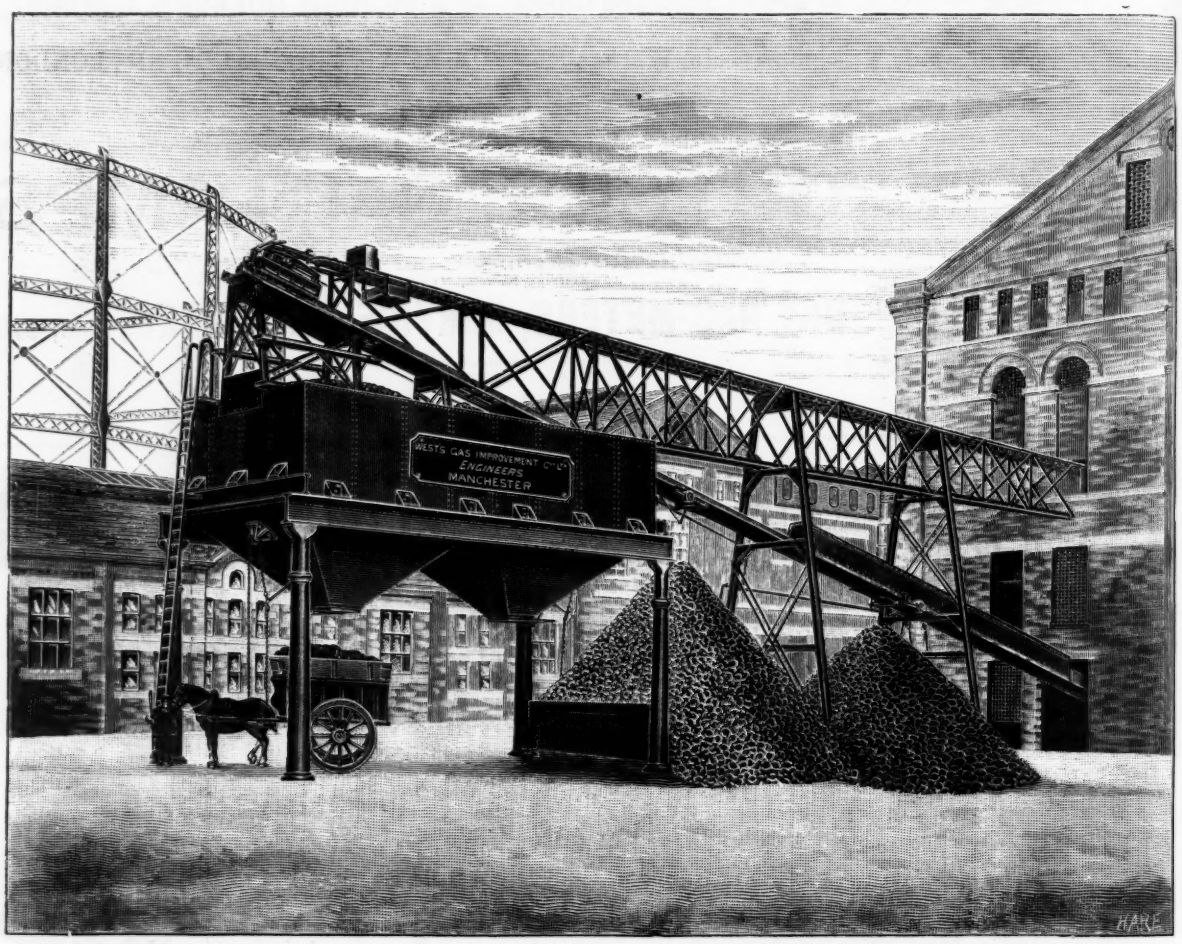

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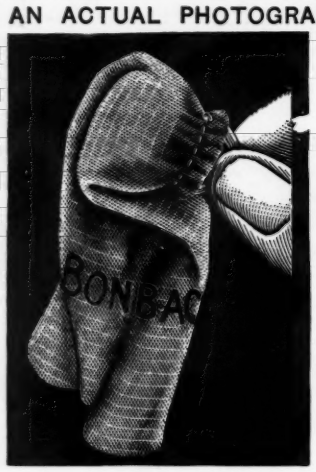

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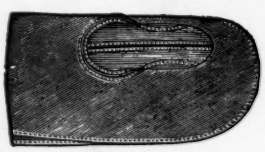

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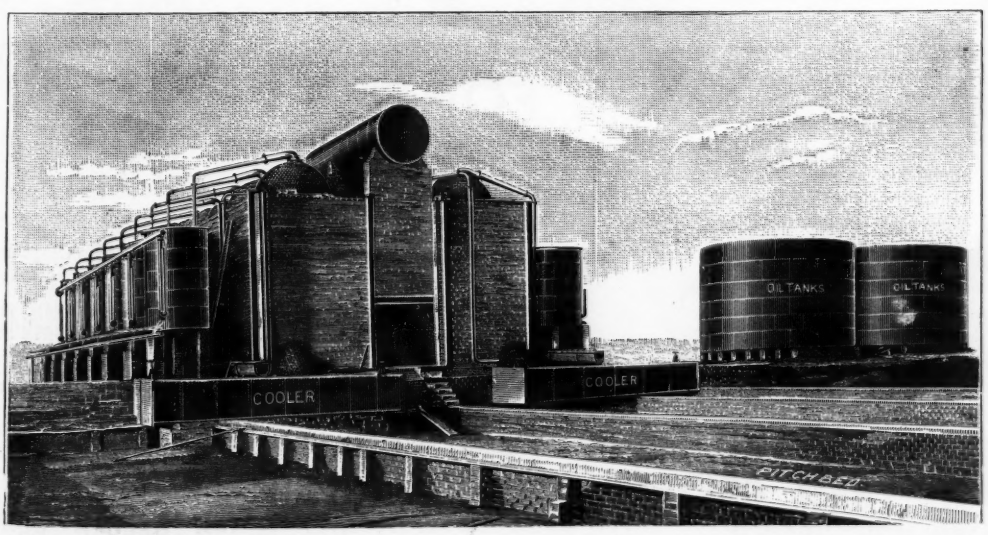

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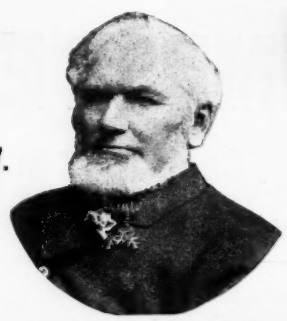
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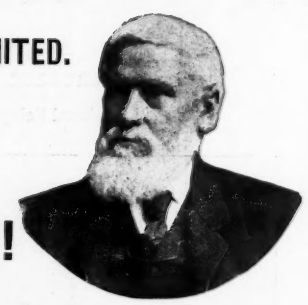
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